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Some psychologically salient meaning properties of lexical items were isolated using judgments about the similarity of meaning within three sets of words: verbs of judging, hypothetical verbs, and locative prepositions. Subjects were asked to rate the similarity of meaning of all possible pairs of words from one of the three domains on a 1-9 scale. These ratings were analyzed by a hierarchical clustering technique. In addition to the usual hierarchical clustering solution, a cohesion score was calculated which indicated how tightly bound a particular cluster was. The results for verbs of judging and prepositions were consistent with those reported by Fillenbaum and Rapoport (1971). In all cases the results were highly interpretable and intuitively satisfying. The verbs of judging were polarized along a good-bad dimension; the salient properties for the hypothetical verbs concerned predictions about the occurrence of uncertain events; and the locative prepositions focused on the deictic relationship between an individual and a three-dimensional object. As a background to the experimental study the possible organization of the lexicon is discussed from both the linguistic and psychological points of view. (Author)

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ORGANIZATION OF THE SUBJECTIVE LEXICON: AN ANALYSIS OF VERBS OF JUDGING, HYPOTHETICAL VERBS, AND LOCATIVE PREPOSITIONS

by

GEORGIA E. MAGNERA

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

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IN

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EDMONTON, ALBERTA

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To my parents

Who always had faith in me

ABSTRACT

Some psychologically salient meaning properties of lexical items were isolated using judgements about the similarity of meaning within three selected sets of words: verbs of judging, hypothetical verbs, and locative prepositions. The experiment for two of the fields, verbs of judging and prepositions, was a replication of Fillenbaum and Rapoport (1971). The third field, hypothetical verbs, has not previously been studied in a psycholinguistic experiment.

Subjects were asked to rate the similarity of meaning of all possible pairs of words from one of the three domains on a 1-9 scale. These ratings were analyzed by a hierarchical clustering technique. In addition to the usual hierarchical clustering solution, a cohesion score was calculated which indicated how tightly bound a particular cluster was.

The results for verbs of judging and prepositions were consistent with those reported by Fillenbaum and Rapoport (1971). In all cases the results were highly interpretable and intuitively satisfying. The verbs of judging were polarized along a good-bad dimension; the salient properties for the hypothetical verbs concerned predictions about the occurrence of uncertain events; and the locative prepositions focused on the deictic relationship between an

individual and a three-dimensional object.

As a background to the experimental study the possible organization of the lexicon was discussed from both the linguistic and psychological points of view. It was concluded that the lexicon could be usefully conceived of as being organized into fields or domains. The work of linguists and psychologists in each of these three fields was presented. A discussion of the experimental results led to speculations of how lexical items might be retrieved from the subjective lexicon. The inadequacies of procedural semantics, the most widely held theory of lexical retrieval, were discussed. A possible alternative view of lexical retrieval was considered in which the subjective lexicon has no fixed mental organization, because a lexical item may be assigned to different semantic domains at different times, depending upon the linguistic and situational context in which the word appears.

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for bravery in facing a flood of psycholinguistics.

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"When I use a word," Humpty Dumpty said,
in a rather scornful tone, "it means
just what I choose it tc mean -- neither
more nor less."

Lewis Carroll

Through the Looking Glass

CHAPTER 1

INVESTIGATIONS INTO THE LEXICON

In the study reported in this thesis a psycholinguistic investigation of three semantic fields -- verbs of judging, hypothetical verbs, and locative prepositions -- was carried out in order to provide insights about the organizational properties of the subjective lexicon, the mental store of lexical items each individual has for his language. This area of research is based on two important assumptions: first, that the members of a given speech community have relatively similar subjective lexicons; and secondly, that lexical items may be grouped into fields on the basis of certain shared properties. The research reported here did not study the properties which the items belonging to a lexical field shared; rather it was an investigation of the features which serve to distinguish among lexical items within a given field. Some important components of the meaning of a lexical item are based on the contrastive relationships they have with other lexical items in the same semantic field.

Meaning in the lexicon

Semantics, or the study of meaning, has been of interest to such varied disciplines as linguistics, psychology, philosophy, anthropology, and sociology. In other words, semantics has been of concern to any discipline

which deals with language and how it is used for communication. Meaning is not easily accessible for study, the major difficulty being that the meanings of words and sentences are psychological concepts. Meaning is in the minds of language users, and it is therefore impossible to study it directly. Anyone interested in studying meaning must devise experimental techniques which might indirectly reveal the semantic organization in the mind of a specific individual. One particular experimental approach, semantic similarity measures, will be evaluated below.

The area of concern here will be restricted to linguistic meaning, that is, the meaning of words and sentences. This eliminates the study of the meaning of social or cultural symbols. Some common symbols relevant in western culture are the colors of a traffic light, or a dove. The meanings associated with these symbols would not be studied by linguistic semanticists. However, restricting the study of meaning to linguistic semantics does not really simplify the problem. Words and sentences have meaning only because a language user can relate a particular word or sentence to some object or event in the real world. Any semantic study will have to account for the real world knowledge and intentions of language users. The question arises as to what extent such an account should be pushed? If it is carried too far, the logical conclusion must be that it is impossible for people to communicate because no two individuals share precisely the same experiences, and

therefore, they have different knowledge about the world. Since their real world knowledge is different they could not possibly have exactly the same interpretation for a particular word or sentence. However, an identical interpretation of events in the real world is not necessary for effective communication. While no two individuals share exactly the same experiences, their perceptions of the world are similar enough to allow them to talk to one another. If this were not the case there would be no social communities, and scientific and technological advances would be impossible because people could not share their knowledge. It should be obvious that a semantic theory cannot be made accountable for all of the real world knowledge that each and every language user possesses.

The assumption must be made that some experiences are common to all members of a given community and that the speakers of a particular language share a certain amount of real world knowledge.

> Given the essential sameness of human organisms and the stability of physical laws, of course, the meanings of most primary perceptual signs should be quite constant across individuals ... Given stability of learning experiences within a particular culture, also, meanings of most common verbal signs will be highly similar ... (Osgood, Suci, and Tannenbaum, 1957, p. 9)

The above quotation makes two assumptions. The first is that all humans perceive physical objects in almost the same way. This is, of course, not always true since an

individual may be perceptually handicapped. However, in the general or normal case people perceive the world in similar fashions because their perceptual systems are anatomically and functionally equivalent. The differences between individual perceptions arise in how the perceived events are interpreted, a psychological phenomenon rather than a physiological one. The second assumption is that individuals belonging to a particular community share the same cultural experiences. The meanings assigned to words and sentences are a result of both kinds of experiences, the universal perceptual and the specific cultural. The study of meaning then, must encompass the experiences and real world knowledge which are common for most individuals. Idiosyncratic experiences, however, will not be accounted for because the most general or normal interpretations of experiences are the ones of basic interest for a psycholinguistic investigation of meaning.

The problem still remains of finding some feasible method for revealing the knowledge that language users share. One approach is to study the lexicon or dictionary of a language. The psycholinguistic concept of a lexicon is not actually equivalent to the conventional notions of a dictionary, and its psychological organization is unknown at this time. Clark and Clark (1977) contrasted the idea of a mental dictionary with a mental encyclopedia. An entry in the mental dictionary contains the phonological shape of a lexical item, its syntactic category, and its meaning

(whatever that is). The mental encyclopedia, on the other hand, "... stores all the facts and generalizations [people] know about objects, events, and states in the world around them" (Clark & Clark, 1977, p. 411). There are many concepts represented in the mental encyclopedia that do not correspond to a single lexical item. For this reason, the Clarks felt that the meaning of a lexical item is not the same as everything an individual knows about the object that word refers to. Rather, the lexical meaning of a word names a category in the mental encyclopedia. For example, "... the lexical entry for dog contains no information about dogs at all. It merely 'names' the category dog, which itself is defined as part of the encyclopedia entry for dog" (Clark & Clark, 1977, p. 413). This approach, however, pushes all of the problems of lexical meaning into the mental encyclopedia. The question of how a category in the encyclopedia represents the meaning of a lexical item still remains. The purpose of the research reported here was to determine some of the organizational properties of the subjective lexicon. In this study it was assumed that the subjective lexicon contains all of the words of a language plus information about the syntactic category a particular word belongs to as well as what the lexical item refers to. The lexicon may also contain information about the affective or emotional meaning of words.

A lexical item is the phonological and orthographic form of a word plus the properties or concepts which give

meaning to that item. When a set of lexical items share a number of properties they are said to form a semantic domain. Within a semantic domain the properties associated with a word give that word a value in relation to all of the other lexical items in that domain. A relationship of similar and contrasting properties holds between members of a semantic domain. This semantic interaction contributes to the meaning of lexical items in the domain. In this way a semantic domain may be said to be organized into a system. With a thorough knowledge of the underlying system an individual can choose the lexical item which should lead to the proper interpretation of an utterance in a given context. Most members of a speech community use words in a similar way, which indicates that they have a similar system underlying their lexicons. The extent to which the system of two individuals differs will determine their ability to carry on a conversation. If two people are using completely different systems (which is unlikely if they are members of the same speech community) they will be unable to communicate.

Language users agree on the meaning of lexical items because most individuals observe a word in similar contexts. The contexts may be of two types, linguistic or situational. Linguistic contexts are the immediate phonological and grammatical environments a particular lexical item appears in. From this type of context people learn which words a lexical item may co-occur with and also

any syntactic restrictions on the occurrence of a lexical item. The situational context is the external or real world situation in which an utterance is produced. By observing a lexical item in a variety of situational contexts children learn how that lexical item may be used to communicate with someone else. Most individuals in a given community will have very similar meanings for a lexical item because they have observed its use in the same types of situational and linguistic contexts. This is the notion of shared experiences discussed above. It is possible that two individuals will not agree on the meaning of a lexical item because they observed it in different contexts, for example, the communist vs. the western meanings of the lexical item democracy. It is unlikely, however, that such a situation would arise between members of the same community. The process of shared experiences leads to the development of a core meaning for isolated lexical items, but it is important to realize that the meaning of lexical items is learned and is not some a priori concept attached to words.

There are a number of advantages in approaching the study of meaning through the lexicon. Lexical items have certain stable, core concepts associated with them. These concepts are present whenever a lexical item appears in isolation. When someone asks the question "What does x mean?", x being an isolated lexical item, he is not usually asking for the meaning of x but simply for its reference. There is a difference between the meaning of a lexical item

and its reference, although the two are often confused. Reference is part of the meaning of a lexical item and is the act of designating the object or set of objects for which a particular word can be used as a name. So, "What is the meaning of x?" is really a request for examples of objects that the lexical item designates. By collecting enough of these contextual cues an individual develops a feeling for the concepts or properties a lexical item represents. At any one time the referent of a lexical item will be a particular event or object, that is to say, the referent of a lexical item will vary with different contextual situations. However, each time a lexical item is used there are some properties or concepts which are always present and the meaning of a lexical item is primarily based on these invariant properties. Thus, the meaning of a word must be learned by observing its use in a variety of contexts. Eventually, language users learn what the various appearances of a lexical item have in common and they can then comprehend and use the word in isolation. Through this process of observing the uses of a word people develop a system for the properties underlying lexical items. The experiment reported in this study was an attempt to discover some of these underlying properties.

Metaphoric extension is an area of language usage in which the core concepts associated with lexical items can be observed. Metaphor is only possible because certain properties are associated with particular lexical items. In

the metaphoric process a lexical item is affected by the context in which it appears and its meaning is slightly different from the usual interpretation. Language users can detect that a lexical item is being used in a non-normal sense. They can also understand the metaphor because they can extend the core meaning of a lexical item to fit a new situation. Consider the lexical item head, for example. Head usually refers to the body part of animate beings which contains their sense organs as well as their brains. There are, however, numerous metaphorical extensions of head; head of lettuce is an extension of the usual shape of heads, i.e., round; head of the table retains the concept of the top or important position with respect to the rest of the body (the sides of the table in this case). This example illustrates that a single lexical item may have a number of different properties or features as part of its meaning. One of these properties will be made more salient than the others in a particular context.

Linguistic approaches

Linguists have used their intuitive-analytic techniques to describe some of the core concepts which contribute to the meaning of lexical items. The various theoretical descriptions of lexical items correspond to different conceptions about the organization of the lexicon. Most linguistic theories treat the lexicon as part of a formal description of language, and do not consider it a

psychological entity. However, some of the linguistic descriptions of the lexicon may provide useful insights into the organization of the subjective lexicon.

One theory which might appear valid as a hypothesis about the organization of the subjective lexicon is that of Katz and Fodor (1964) who proposed that the meaning of a lexical item could be expressed as a sum of semantic markers or features. All lexical items could be broken down into their component parts and it was the task of the linguist to determine what the appropriate semantic features were. The semantic features were supposed to represent the core meaning of a lexical item. However, they were also useful from a formal grammatical point of view because features offered an explanation for semantically anomalous sentences such as (1).

1. *The bridge laughed.

Laugh is an intransitive verb which requires an animate subject, and bridge has the property of being inanimate. Therefore the two lexical items are incompatible and this sentence is said to be nonsensical. This approach, however, is too rigid since it does not allow for metaphorical extension. Once a set of features is assigned to a lexical item, they remain fixed. The example head of the table given above would be considered just as nonsensical as (1) since tables are not animate and head has the feature of belonging to an animate being.

Another difficulty with the Katz-Fodor proposal is that

all features are binary. Katz and Fodor assumed that the lexicon is organized in an either-or fashion so that objects are either human or non-human, humans are either male or female, there being no neuter sex. Strict adherence to a binary feature system does not seem feasible because many real world objects cannot be definitely assigned a positive or negative value for some of the features proposed by Katz and Fodor. The concrete-abstract opposition, in particular, is perplexing to linguists. There are many items which seem to have both features simultaneously. Electricity, for example, is an obvious physical force yet it is not something that can be held in one's hands. It is equally unclear which features should be assigned to the lexical item idea; an idea is a notion in someone's head which makes it abstract, but an idea may also be said to be concrete if it has a practical application for solving a particular problem.

Binary features are inadequate in yet another way since not all features are relevant for every lexical item. Theoretically, lexical items should have a negative value for all features for which they are not designated positive. Each lexical item must be marked for every possible feature, but some features seem to have no importance for a particular lexical item. Rocks for example, are neither male nor female. What would be the point of specifying these features as part of the meaning of rock? To do so would contribute nothing to the linguists'

understanding of the meaning of rock.

The final problem with the Katz-Fodor theory is that each lexical item was treated as a separate entity. A positive or negative value was assigned to the features of one lexical item and then independently for the next. There was no way of accounting for the fact that some lexical items can be grouped together on the basis of sharing certain features. Consider the following example adapted from Lyons (1968, p. 470):

2.	a) man	woman	child
	b) bull	cow	calf
	c) stallion	mare	foal
	d) ram	ewe	lamb

Each row and each column represents a set which shares some semantic features or components. Row a has the shared feature human while row b has the shared feature bovine, and items in the first column are all male while items in the last column are all non-adult. There are many different formal ways that the semantic features might be specified but the similarities and differences between the sets should be intuitively obvious to all native speakers of English. The type of analysis which deals with sets of lexical items sharing some features and contrasting on others is called componential analysis. This technique is more useful than the Katz-Fodor system for providing insights into the organization of the subjective lexicon.

Componential analysis makes the assumption that lexical items are arranged into sets or fields. The lexical items

belonging to a given field must have some major features in common thus allowing the analyst to say that a field is present. In (2) the common feature would be animate or maybe mammal. The features used in describing the organization of this set need not be used elsewhere. It is no longer necessary to specify irrelevant features, as in specifying male or female for types of rocks. Completely different features might be used for describing the similarities and differences between types of rocks; igneous, metamorphic, and sedimentary are terms for one type of contrast. These properties are obviously irrelevant for the set of items in (2).

The underlying justification for componential analysis is predicated on the assumption that meaning is a relational concept. A lexical item only has meaning because it contrasts with, and at the same time, is similar to other lexical items. The principles of contrast and similarity underlie the systematic organization of the lexicon.

> It is one of the cardinal principles of 'structuralism' as developed by de Saussure and his followers, that every linguistic item has its 'place' in a system and its function, or value, derives from the relations which it contracts with other units in the system. (Lyons, 1968, p. 443)

This relational view is also accepted by some psychologists (Fillenbaum & Rapoport, 1971; Miller & Johnson-Laird, 1976), although their view of the organization of the lexicon is somewhat different from the formal linguistic one and will

be discussed below. It seems likely, however, that the relational notion of meaning is an important organizational principle of the subjective lexicon. Componential analysis defines a different set of formal linguistic structures from those used by Katz and Fodor (1964).

The linguistic relationships between lexical items are of two types in componential analysis, hierarchical and contrastive (Lyons, 1968; Palmer, 1976). The hierarchic relation can be described in terms of hyponymy, or inclusion. A class of lexical items is determined which may have a superordinate term or class name. All the members included in the set are hyponyms of the superordinate term. According to the theory, the hyponym has all of the features of the superordinate term plus at least one additional feature, so that anything that may be said about the superordinate term may also be said about the hyponym but not the other way around. The classic example of a hierarchical set is the genus-species classification of biological forms (Lyons, 1968).

The contrastive relationship is equivalent to the notion of sets or fields discussed above. The field as a whole may have a superordinate class name but each member of the field contrasts with every other member. There can be no situation where two items from a semantic field may be used in free variation since members of the same field are mutually exclusive. A set of features distinguishes one lexical item from another within a set, but the features

used to contrast terms within a set might not be used to contrast one set with another. The contrastive relationship may be thought of as a semantic scale or continuum which has various shades of a component of meaning specified on it.

A good illustrative example of a semantic field is temperature terms with hot and cold at the extremes and warm and cool marking middle ranges. Other possibilities along the scale may be delimited by the meanings of freezing, boiling, or tepid. If the language has no specific lexical item for some possible point on the scale, speakers must resort to an extended explanation using many phrases and sentences. The point is that an individual must choose only one of the above terms to refer to a specific temperature, so the terms form a contrastive set. To describe a temperature by using the lexical item rhubarb would be nonsensical because it is from a different semantic set.

The hierarchical and contrastive relationships interact in such a way that a contrastive set might be thought of as a level in a hierarchy.

> We can think of hierarchical relations as characterizing the external structure of a contrastive set - how one set of contrastive terms is related to other sets - and of the dimensions of contrast within the set as characterizing its internal structure. (Miller & Johnson-Laird, 1976, p. 266)

This organization can be illustrated by color terms as shown in Figure 1. The whole set in Figure 1 has a hierarchical structure. Each level forms a contrastive set which has a

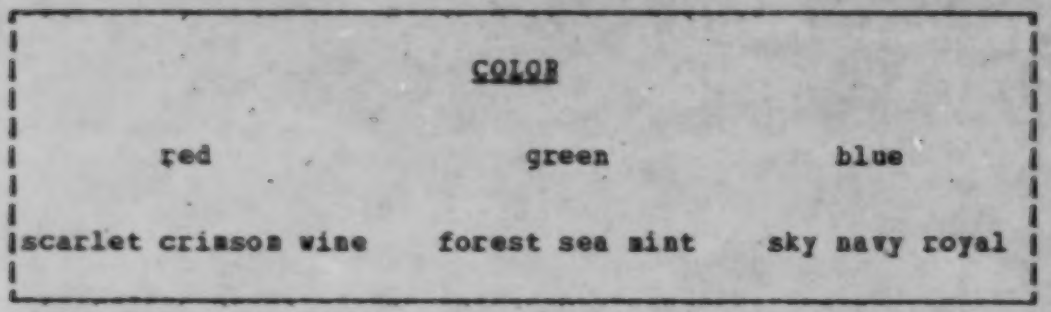

Figure 1: Contrastive sets in a hierarchic relationship.

superordinate term from the next level up. As one moves down the hierarchy the terms become more specific. A hierarchic set contrasts with other hierarchically organized sets, although this point is never explicitly stated by Lyons (1968) and others who have discussed this type of semantic organization.

The relationships which have so far been described are formal linguistic ones, and are not based on a psychological notion of meaning. It is probably not the case in the subjective lexicon that each level is a self-contained contrastive set. In Figure 1, for example, crimson might very well be used in contrast to blue or green. There are a number of ways to reorganize the domain of color terms so that all items can participate in the contrastive relationship. First of all, the lexical item blue could be considered both a superordinate term and a member of the contrastive set dominated by that term. This would indicate that there are two different blues, blue 1 and blue 2 (cf. Lehrer, 1974). This solution has the advantage of preserving a rigid hierarchical system but it raises more questions than it answers. What point on the continuum of

blue is represented by blue 2? There would be very little agreement among different individuals on this point. The question also arises as to which point on the spectrum the superordinate term blue refers; for some people it might be navy and for others royal. In a field such as color terms the rigid hierarchic system seems to fail.

An approach which has more psychological validity would be to extend the notion of contrastive set to include all of the terms under the heading of color. This is a broader notion of semantic domain which would include all terms having some common properties. In other words, the notion of hierarchy is not necessary, except in obvious cases such as the genus-species classification. An extended notion of semantic domain might allow for the inclusion of striped and polka-dotted in Figure 1. These terms seem to have some relationship to color terms but not in a hierarchic sense. This approach to contrastive sets is more intuitvely satisfying and underlies psychological investigations of sets of lexical items (Deese, 1965; Pillenbaum & Rapoport, 1971; Miller & Johnson-Laird, 1976). The experimenter chooses sets of lexical items which seem to be related in some fashion but he does not assume that they have any particular organization (except of course, when testing specific hypotheses). The purpose of conducting an experiment with a lexical domain is to determine what relationships the subjects perceive among the items.

Psycholinguistic studies

The organization of the subjective lexicon and the meaning of lexical items has been of concern to some psychologists. One of the more common experimental methodolcgies for studying lexical meaning has been the elicitation of similarity measures. The assumption is that if subjects judge two words to be similar in meaning, these words must share some properties or semantic features and probably belong to the same semantic domain. In such experiments (H. H. Clark, 1968; Fillenbaum & Rapoport, 1971; Miller, 1971), similarity is not specifically defined. Carroll and Wish (1974) argued that similarity judgements reveal basic psychological relations, and that similarity should be taken as a primitve undefined psychological concept. Subjects should be able to decide for themselves which dimensions cr features of lexical items they will concentrate on. Different pecple may use different dimensions but with enough subjects a consistent pattern should emerge if, in fact, there is one.

Similarity scores are usually converted to distance measures for analysis by some statistical technique, the most common being multidimensional scaling or hierarchical clustering. These techniques reveal dimensions or properties underlying the data. One of the basic assumptions of these types of analyses is that there are dimensions or properties to discover; that is to say, that the set of stimuli being studied are indeed related in some

way. This assumption enables the experimenter to interpret the data. As Wish and Carroll (1974, p. 453) pointed out, "...if nothing were known about the stimuli it would be impossible to interpret the dimensions." On the basis of how the data cluster the experimenter makes hypotheses about the psychological properties which caused the data to be organized in such a manner. These statistical procedures of hierarchical clustering and multidimensional scaling are applicable to all types of similarity measures no matter how they are obtained.

Miller (1971) described four different methods for measuring similarities among sets of lexical items. These were: scaling, association, substitution, and classification. In the scaling method subjects are asked to rate the similarity between all pairs of lexical items in a given set. Usually the judgements are based on a five or nine point scale. This is perhaps the best method for dealing with lexical fields or domains since a distance measure can, on the basis of these judgements, be calculated for each pair of items. The disadvantage of the scaling technique is that it requires the subjects to make a large number of judgements ($N(N-1)/2$), which sets a pragmatic limit on the number of terms which can be studied in a single experiment. This scaling technique was used in the experiment reported here because the information gained from having a similarity measure for each pair of words outweighed the disadvantage of only being able to study a

limited set of items.

With the association method, subjects are given a list of terms and are asked to produce the first word that comes to mind for each lexical item. This technique was used by Deese (1965). Association methods assume that similarity of meaning is based on how many associative responses two words share. This is not a good measure of similarity of meaning since associative responses are often the result of the syntagmatic collocation of two words, for example, table might evoke chair because speakers often talk about tables and chairs together.

The semantic differential technique of Osgood, Suci and Tannenbaum (1957) is another association technique and also is based on the assumption that words which are similar in meaning share a large number of properties. In this technique, subjects are asked to rate lexical items on bipolar adjective scales, for example, good-bad. A large number of these scales define a semantic space, with every lexical item falling somewhere in this space.

> Each semantic scale, defined by a pair of polar adjectives, is assumed to represent a straight line function that passes through the origin of this space, and a sample of such scales then represents a multidimensional space. (Osgood, Suci & Tannenbaum, 1957, p. 25)

The difficulty with the semantic differential method is that it only measures affective or connotative meaning and is not sensitive to other aspects of meaning. It also forces judgements about the properties which a lexical item might

have since the scales are all given and the subjects do not have the freedom of finding their own underlying dimensions. Another problem with this technique is that the scales may be interpreted either metaphorically or literally, and there is no control over which type of interpretation a subject uses. The literal or metaphorical application of a particular scale probably depends upon the stimulus being rated, so that the same scale may be used in both fashions during the course of a semantic differential experiment.

The third method discussed by Miller (1971) is substitution. With this technique subjects are presented with a sentence frame which has a vacant slot. The subjects are then asked to supply a lexical item for the blank. The substitution technique was used by H.H. Clark (1968) in a study of the meaning of prepositions. He did not instruct his subjects to produce sentences with the same meaning; the only requirement for substitution was that the new sentences be sensible and grammatically acceptable. Underlying Clark's use of this method was the assumption that, "... two prepositions are treated as semantically related when they are interchangeable in discourse." (H. H. Clark, 1968, p. 427).

This type of assumption confounds semantic and syntactic factors. The insertion of a lexical item into a sentence frame is largely a syntactic matter. In most sentence frames there are restrictions on the types of

lexical items which can co-occur. However, it is quite possible to have two semantically related lexical items which belong to different syntactic categories; for example, verbs of motion (run, hop, walk) share many properties with directional and locative prepositions (Bennett, 1975; Leech, 1969). Verbs of motion and locative prepositions could not be used interchangeably in the same sentence frame, but they might be considered similar in meaning by naive subjects. In order to effectively study similarity of meaning, subjects must be instructed to supply words which keep the same meaning for the sentence; otherwise the experimenter is studying syntactic forms, as well as semantic similarity.

The last method, which was the one favored by Miller (1971), is classification. Subjects are given index cards with one lexical item on each card. They are then asked to sort the cards into piles on the basis of similarity of meaning. The disadvantage of this technique is that a lexical item may be assigned to only one class at a time. There is no way for subjects to indicate that x is similar to both y and z but for different reasons. For example, man in (2) above may be considered similar to both woman and ram depending on how the organziation of the set of items in (2) is perceived. In spite of this problem, the classification technique has been employed by many investigators of semantic similarity (Miller, 1971; Pillenbaum & Rapoport, 1971), perhaps because large sets of terms can be used as stimuli in a particular experiment.

A variation of the classification technique was used by Fillenbaum and Rapoport (1971). They asked their subjects to form trees linking terms which they felt to be most similar in meaning. Subjects could form any links they wished but they ultimately had to produce a tree in which all of the terms were connected. This presented difficulties for the subject who saw distinct subgroupings of terms but felt it was completely arbitrary how the subgroups were linked into one large group. The motivation for Fillenbaum and Rapoport's work was methodological. They were interested in comparing various techniques for the analysis of similarity data obtained in the manner described above. Nine different semantic domains were studied, two of which (verbs of judging and prepositions) were also examined in the present experiment. Once Fillenbaum and Rapoport (1971) had obtained their similarity measures they submitted them to two different analytic techniques, multidimensional scaling and Johnson's hierarchical clustering. The results from these two methods were comparable for each of the nine lexical sets.

Linguistics and Psychology

Fillenbaum and Rapoport (1971) wrote that the aim of their work was, "... (1) the discovery of meaning relevant properties, and (2) a characterization of the nature of their structural organization." (Fillenbaum & Rapoport, 1971, p. 241). Their first aim can be accomplished no

matter which method of analysis is used, but the 'structure' revealed by the data will, to a certain extent, depend on the analytic technique. Multidimensional scaling will lead to a dimensional interpretation and hierarchical clustering will result in a categorical organization of the data. It is very difficult to make any claims about the structural organization of lexical items in a semantic domain given simply the similarity measures. Semantic similarity data can reveal the underlying properties which subjects used to organize a particular semantic domain into subgroups. Whether these properties are dimensional or features is an open question; the lexicon is probably not organized on either a strict featural or dimensional basis. On the basis of evidence from experimental investigations, it appears that each lexical domain may have its own type of internal structure; some domains may have a dimensional organization, based on continuous features, while others may be organized on the basis of discrete features.

The study of the lexicon is one area of language research where linguistic and psychological techniques complement each other. Similarity measures give the experimenter an objective basis for studying the organization of semantic domains, but the choice of particular lexical items for stimuli is intuitive. The psychologist can use the linguistic method of componential analysis to determine which lexical items belong to a particular semantic domain. With this information the

psycholinguistic researcher can decide which words to use as stimuli in a given experiment. If a set of lexical items were chosen randomly from the dictionary it is unlikely that any common features would emerge. The subjects might be able to complete a task using randomly chosen stimuli, but the results could hardly be considered revealing of semantic similarity.

> While one can find relations and similarities among almost any set of terms, even if randomly chosen, our interest was not in the uses of the creative imagination but in the discovery of semantic properties on which there is substantial consensual agreement in the service of communication. (Fillenbaum & Rapoport, 1971, p. 235)

Naturally, the experimenter would like a more objective method than componential analysis for choosing stimuli, but people do intuitvely agree on certain semantic domains. Language users can also agree on what terms seem central to a particular domain and which are peripheral, because they have developed a concept about the prototypicality of certain terms. For example, a carrot is considered to be a better representative of the class of vegetables than a mushroom (Rosch & Mervis, 1975). The experimenter tries to include all of the 'central' terms as well as some of the peripheral ones. In this way the general organization of lexical items in a particular semantic domain may be studied.

Essentially, both the experimental and linguistic

methods are based on the intuitions of native speakers. Miller and Johnson-Laird (1976) considered componential analysis as an objective method for determining which lexical items belong to a particular semantic domain.

> The analytic approach assumes that any two words that can be analyzed into common conceptual components are to that extent in the same semantic field; the more conceptual components two words have in common, the smaller is the smallest semantic field that contains them both. (Miller & Johnson-Laird, 1976, p. 374)

This position is attractive but, unfortunately, it is no different from the intuitive approach which "... asks people to make intuitive judgements of the similarity of meaning between any two words" (Miller & Johnson-Laird, 1976, p. 374). In componential analysis the components or properties of lexical items are determined by the intuitions of an individual analyst. This technique is not objective because two different investigators will probably not find the same set of underlying components. Determining the members of a semantic set is an intuitive process whether it is based on a detailed componential analysis or similarity data. The difference between the two approaches is that one is based on the judgements of a single individual while the other is based on a sample of the general population.

Psychological models

The discussion so far has centered on the semantic organization found within a particular set of terms. There are two theories about the global relationship of lexical items to each other, the set-theoretic and the network models. These theories are proposed as models of the organization of semantic memory. The network theory assumes that all concepts which correspond to lexical items are connected to one another by various pathways. The more links two nodes share, the more similar they must be in meaning (Collins & Loftus, 1975; Hollan, 1975; Rips, Shoben & Smith, 1973). A sentence is understood when all the pathways of its lexical items are activated. This theory is very efficient for describing the functioning of superordiate relations, for example, robin will activate a path to bird but bird will not activate a direct pathway to robin. This theory is similar to, and shares the problems of, the hierarchical theory discussed earlier. For example, to show that robin and cat are both members of the category animal, one would have to trace a network from each term until the traces converged at the node for animal. Another inadequacy of the model is that it has no mechanism for preventing a random activation of the pathways linking various lexical items. Without such a control, the comprehension of sentences would be a trial-and-error process.

The set-theoretic model assumes that the meaning of

lexical items is represented by sets of features or attributes. An individual can determine if two lexical items are similar in meaning by comparing all of their features. The more features they share, the more similar their meaning is. The set model cannot adequately deal with superordinate relationships except in the sense that a superordinate and its hyponym will share several features. This theory is similar to the contrastive set notion discussed above. The set model is inadequate for showing that sets of items may be semantically related to each other; each set is considered an isolated entity.

In formal linguistics these two models are combined into one theory; in psychology they are considered independent, competing theories. They might, however, be combined. Hollan (1975) attempted to show that any "... set-theoretic model can, without loss of explicatory power, be formulated as a network model..." (p. 154). Conglomerates of features which represent the meaning of lexical items would be connected by network links. Hollan's proposal seems like a simple solution but it is inadequate as a psychological model of the subjective lexicon. The similarities of meaning between lexical items do not only arise because the words share links in a hierarchic structure; some seemingly diverse lexical items may be linked on the basis of the features attached to them. For example, cardinal and tomato both have the property of being red. One might argue that features such as red are not an

intrinsic part of the meaning of tomato or cardinal, but this argument only raises the question of which features are to be attached to lexical items in an extended network model. A model of the subjective lexicon which does not force a distinction between inherent and peripheral meaning features would avoid such problems. Such a model would probably utilize the expanded notion of semantic domain discussed above.

It is useful to have psychological models of semantic organization, but these theories are often considered to be representative of the way the lexicon is structured in the mind. In other words, these models are supposed to be actual representations of states of knowledge about, or retrieval processes for, lexical items. This claim, of course, cannot be empirically tested directly. The most that can be said is that the data obtained from a particular experiment do not contradict the proposed model. The assumption on which the present study was based is that any structure or organization which emerges from analysis of the data is a convenient representation of the data. The patterns which people impose on the data can be observed but these patterns are only indirect indications of how the lexicon is psychologically organized. Deese (1965) described the differences between these two attitudes.

> There are, in general two approaches to the research for the underlying structures that provide the framework for relations among words, one of these is hypothetico-deductive. It requires

> that we define the nature of schemata by stating certain propositions. We then look for the empirical evidence which supports the implications derivable from our propositions. The other approach is inductive. It asks us to reduce the statistical relations among words to simple structures which, in turn, allow us to recover the main features of the original statistical relations among words in linguistic usage. (p. 66)

The inductive approach was followed in the experiment reported here. Any structural or organizational features which are presented below were suggested by the data analysis. It was assumed that English speakers have some internal system which caused them to organize the data in a certain way. This system might be a similarity-detection system, similarity being based on some underlying properties. It was not assumed that language users store sets of related lexical items but that, given a coherent set, they will conceive an organization for it based on their specific experiences with the items in the set.

Summary

In summary, lexical items can be grouped into fields or domains on the basis that they share some features or properties. The features are based on the properties which language users perceive in lexical items and are therefore psychological. The properties which differentiate members of a lexical domain can be determined indirectly by psychological experimentation. Experiments cannot reveal the features which all of the lexical items have in common,

but only those features which are contrastive for the set studied. The presentation of certain lexical items as a set is based on the assumption that they share some properties. Judgements about which lexical items belong to a particular semantic domain are intuitive, but most speakers of a language seem to agree on the members of a specific domain. Once a set has been chosen, similarity measures can be obtained which will reveal some pattern of organization for that lexical domain. This study looked at the pattern of organization of three lexical sets: hypothetical verbs, prepositions, and verbs of judging. These three domains will be discussed in the next chapter.

CHAPTER 2

THREE SEMANTIC FIELDS

The description of a semantic domain may be based on two different approaches, a formal linguistic approach or a psychological investigation of the salient properties for that domain. It is usually the case, however, that an investigator uses a psycholinguistic approach which combines methods from both disciplines. Linguistic methods help determine which sets of lexical items might be available for study as semantic domains by giving the experimenter some idea of the features which are the same for a large set of related lexical items. In particular, componential analysis enables the investigator to determine what properties might be important in distinguishing members of a particular domain. The major objection to formal linguistic methods is that they are based on the intuitions of one or two linguists. Once an investigator has determined that there is a semantic field available for study, he uses an experimental approach to determine if the judgements of naive speakers correspond to linguistic descriptions. Usually there is a good agreement between the two, but the experimental investigation often reveals some interesting aspects of a semantic domain that were not considered by linguists.

The present study dealt with three domains: verbs of judging, hypothetical verbs, and prepositions. All of the

items belonging to a particular set share some syntactic and semantic properties, although there are some terms in each set which are not usually syntactically classified as members of that particular domain. For example, the distinction between prepositions and adverbs is not clearly defined, and some members of the preposition set are occasionally treated as adverbs in the linguistic literature. This illustrates the sort of the discrepancy which can arise between syntactic and semantic methods of classification. Although the syntactic and semantic behavior of lexical items work together in determining lexical fields, there are some 'gaps' in the syntactic or semantic systems, so that a lexical item may belong to a semantic field even if its syntactic behavior does not match other members of that field.

Some of the recent work in the three domains is discussed below. The discussion includes a review of formal linguistic analyses, as well as of any relevant psycholinguistic investigations. This chapter is intended to provide an overview of some of the properties which have previously been hypothesized for each of the semantic domains.

Verbs of Judging

The verbs of judging are "... the words speakers of English use in speaking about various types of interpersonal relationships invclving judgements of worth and

responsibility" (Fillmore, 1969b, p. 99). Some members of this lexical field are: accuse, blame, acquit, criticize, and excuse. The verbs of judging belong to the larger semantic domain of lexical items concerned with interpersonal relations. Interpersonal relations were defined by Heider (1958) to be those relations between a few people, usually two, that are based on common sense or "naive psychology". Naive psychology stems from the intuitions people have about social situations which lead them to behave appropriately. Heider (1958) listed several concepts which underlie an individual's intuitive analysis of interpersonal relations. These were the following: concepts about the mutual environment of the interacting individuals; concepts about perceiving, which is the direct contact the individual has with the environment; concepts about the individuals being affected by the relationship; concepts about the positive or negative evaluation of the situation; concepts which deal with standards of behavior; and four concepts which deal with the possibility of bringing about some change in the environment, cause, can, try, and want (Heider, 1958). These concepts were used by Heider to describe types of behavior, but they might be thought of as a possible set of psychological properties underlying the lexical domain which refers to interpersonal behavior. At a minimum, such words would have, as a part of their meaning, properties describing the interacting individuals and their common environment.

Osgood (1970) studied the semantic system of a large (210) set of interpersonal verbs. He based his analysis of this set on a type of componential analysis. First, Osgood (1970) hypothesized six features that could distinguish every verb from every other verb. He then tested groups of subjects to determine which of his features were salient for the general population. Osgood's features were not really binary since he allowed a specification of zero when a feature was irrelevant for a particular verb. The six intuitive features were, Associative-Dissocative, Initiating-Reacting, Directive-Nondirective, Tension increasing-Tension decreasing, Ego orientated-Alter orientated, and Supraordinate-Subordinate (Osgood, 1970). Osgood found that the Associative-Dissociative, Supraordinate-Subordinate, and Ego orientated-Alter orientated were the properties most salient for the subjects he tested. He concluded:

> ... that the semantic system for interpersonal verbs 1) is not nested 2) is partially replicated (features applying to all terms only when zero codings are allowed 3) is partially ordered (but in terms of psychological salience rather than logical inclusion), and 4) is partially dependent (with features correlated in usuage to various degrees). (Osgood, 1970, p. 42[illegible])

This statement represents a very strong hypothesis about the organization of the semantic domain of interpersonal verbs. As Osgood himself admitted, the experimental procedure used probably imposed some organization on the set of terms. If,

for example, Osgood had used Johnson's hierarchical clustering technique, he would have "discovered" a hierarchically ordered system.

Osgood was attempting to discover the organization underlying a large set of terms. He did not consider the possibility that there may be many subcategories in the semantic domain of interpersonal relations and that each subcategory may have its own system of relations. In the present study, attention was limited to the verbs of judging because it was felt that by restricting the set of terms to a specific domain a larger number of salient meaning properties would be revealed than were found by Osgood. The verbs of judging still constitute a fairly extensive set of items, but features can be hypothesized which are limited to this set and a more in-depth analysis than Osgood's should be the result. If a set of items is quite diverse, as were Osgood's stimuli, only a few features can be found which are common to all items in the set. For this reason, Osgood found only three salient features. It was unlikely that he would find a large set of features which could be used to contrast and compare all of the verbs he studied. The contrast in meaning between <u>love</u> and <u>blame</u>, for example, can be characterized by the notion that these two words are from different semantic domains; <u>love</u> is a member of the domain of emotion terms, and <u>blame</u> belongs to the domain of judging. Domain membership is the most general property necessary to distinguish between <u>love</u> and <u>blame</u>. However,

to characterize the difference in meaning between blame, criticize, and accuse, all negative judging terms, a more refined set of terms is needed to show the contrasts in meaning. Osgood's analysis was only capable of detecting gross differences among the lexical items he studied, such as domain membership.

Fillmore (1969b) analyzed a subset of the verbs of judging in terms of what he called 'role structure'. Role concepts are similar to some of Heider's (1958) interpersonal concepts; in particular, those concepts which were concerned with evaluations of a situation and how the interacting individuals are affected by the situation. The major difference between Heider (1958) and Fillmore (1969b) is that the latter's formal linguistic analysis was specifically tailored to the verbs of judging. Fillmore suggested that the role structure can be described by a Situation; the individual Affected by the situation; the Defendant, or individual responsible for the Situation; and the Judge, the individual who makes moral evaluations about the Situation or Defendant (Fillmore, 1969b). The role concept of Situation is particularly useful for describing the various meaning aspects of verbs of judging. The Situation associated with a particular verb might be praiseworthy (e.g., praise) or blameworthy (e.g., scold), other aspects of the Situation concern presuppositions about whether it actually occurred (e.g., criticize) or may not have occurred (e.g., accuse). It is also not necessary to

specify every feature for every member of the set; justify, for example, does not require any specification about the Judge, while praise and scold do.

Fillmore's analysis was based on the componential method, but instead of hypothesizing features, he claimed to be defining the presuppositions necessary for the correct use of the verbs of judging. The distinction between features and presuppositions is not a crucial one and this discussion will assume that the features attached to a lexical item are the same as the presuppositions of that lexical item. In any case, Fillmore's system of role concepts was an a priori attempt to define the psychological properties underlying a semantic set.

Fillenbaum and Rapoport (1971) attempted to determine whether the a priori system proposed by Fillmore was supported by data obtained from naive subjects. They used a set of 30 verbs of judging which included all of the verbs analyzed by Fillmore (1969b) as well as 11 verbs studied by Osgood (1970). Fillenbaum and Rapoport asked 26 university undergraduates to construct labeled trees in which each node represented a lexical item and the link between two nodes represented a semantic similarity judgement between two items. The semantic distances between words revealed by these trees were then analyzed by two statistical techniques, multidimensional scaling and hierarchical clustering, which revealed similar results. Fillenbaum and Rapoport (1971) found three basic groups: an Admit-Forgive

group, an Attribute-Praise group, and an Accuse-Condemn group. A full list of items in each group is given in Figure 3, Chapter 4 (page 81).

In their discussion, Fillenbaum and Rapoport noted that their results could be interpreted using Fillmore's (1969b) role features. The Admit-Forgive cluster could be divided into two subgroups, an Admit group, which presupposed a bad situation; and a Forgive group in which,

> [the] terms presuppose a Defendant responsible for a bad Situation and an active Judge, who either explicitly denies the responsibility of the Defendant for the bad Situation (acquit, clear, and perhaps excuse) or absolves him of its consequences (forgive, pardon). (Fillenbaum & Rapoport, 1971, p. 205)

All of the terms in the Attribute-Praise cluster involved "... an assertion as to the responsibility of the Defendant for the Situation ..." (Fillenbaum & Rapoport, 1971, p. 205). In addition, the Praise terms assumed a positive evaluation of the situation by the Judge. The last group, Accuse-Condemn, was based on the negative evaluation of the Situation. The Accuse subcluster presupposed "... a bad Situation for which the Judge is asserting the responsibility of the Defendant" (Fillenbaum & Rapoport, 1971, p. 205). The Condemn subcluster was also based on a negative evaluation of a bad situation, but it seemed to carry a stronger assertion as to the responsibility of the Defendant.

In addition to the study discussed above, Fillenbaum

and Rapoport (1974) were able to repeat their experiment using Fillmore as a subject. They wished to determine whether a sophisticated judge such as Fillmore would produce results similar to those obtained from naive subjects. The results were remarkably similar; except for the placement of one or two items, they found three groups which corresponded to the three groups in the earlier experiment. There is no method of determining whether the naive subjects (and even Fillmore himself) were using Fillmore's role concepts or some other set of features, but the consistency of the analyses indicates that the system underlying the semantic domain of verbs of judging must contain properties similar to Fillmore's role concepts. Whether or not the features underlying the verbs of judging can be used for the larger domain of interpersonal verbs is an unanswered question, since these role concepts were specifically determined for the verbs of judging.

Hypothetical Verbs

The English modal verbs form the core of the semantic domain of hypothetical verbs. There is very little agreement about the semantic characteristics of this set. The traditional structuralists' notion was that the set of modals is a closed set with the following members: can, (could), may, (might), shall, (should), will, (would), must, ought to, need, and dare (Joos, 1964; Twaddell, 1963). Could, might, should, and would were usually considered to

be the past tense forms of can, may, shall, and will respectively. Modals were formally described as part of the verbal auxiliary system on the basis of the following characteristics: they appear in first position in the verb phrase, in questions the modals invert with the subject, and modals are directly followed by not (or n't) in negation. This behavior is similar to that of the other verbal auxiliaries, have, be, and do. In addition, modals do not take a third person singular inflection, which distinguishes them as a separate class of verbs. The syntactic behavior of modals is observable in English utterances. However, when it comes to the meaning which the use of a modal signifies, there is very little agreement among linguists. Opinions range from the position that the meanings of modals are axiomatic and cannot be described to the position that modals are an independent syntactic and semantic class. The following two quotations illustrate the range of opinion about the meanings of modals:

> First, when English is learned natively the meanings of those eight modals are learned so extremely early - necessarily before the child is ready for kindergarten - that as an adult one has left them buried deep in the subconcious where they are inaccessible to rational scrutiny by anyone but a ruthless professional analyst of languages; and when they are seen laid out and dissected as they will be here, we are bound to feel that we are witnessing the anatomizing of our own flesh and blood. (Joos, 1964, p. 147)

> In English they [modals] straddle the line between verbs and non-verbs

> tantalizingly: there are strong arguments for considering them highly peculiar verbs, but cases have been made in the past for considering modal as a separate class, parallel to say, noun or verb, semantically - related to neither. (Lakoff, 1972, p. 229)

In traditional linguistic descriptions, modals were considered to be function words, having no semantic status. However, the meanings of modals can be described just as the meanings of any other set of related terms can be described. One of the purposes of the present study was to show that the meanings of modals could be investigated by psycholinguistic means. If the semantic similarity technique is useful for investigating semantic domains, it ought to be applicable to the set of modals. Futhermore, there are probably no pure 'functors' in language. All lexical items must have some relational meaning attached to them; that is to say, they have some slot or place in a semantic domain.

Modals are used when speakers want to discuss hypothetical situations. There is surprising agreement among linguists on this characteristic of the modal system. The differences arise in how this hypothetical system is to be described and what relationship holds between members of the set. Even structural linguists such as Joos (1964), who felt modals had no semantic content, would agree to the hypothetical nature of the modal system. He proposed three binary classifications to describe the meanings of modals: Adequate vs. Contingent, Casual vs. Stable, and Assurance

vs. Potentiality. (It is interesting to note that three binary features is the minimum set necessary to distinguish among eight modals.) A similar set of features was proposed by Marino (1973): Necessity, Possible, and Execution. Although Joos and Marino were working within the framework of different grammatical theories (traditional structuralism vs. transformational-generative grammar), their analyses were rather similar. They both proposed a minimum set of binary features necessary to distinguish between all of the modals. These analyses have all the problems associated with binary feature systems which were discussed in Chapter 1. It is also the case that the most economical set of features may not be the best description of the meanings associated with modals, since attempts to preserve a symmetrical system may lead the linguist to overlook some important aspect of the meanings of modals.

Other attempts to describe the meanings of modals do not make use of binary features. Rather, the similarities and differences between the meanings of the modals are described in terms of Gesamtbedeutung or general meaning. This type of semantic analysis is widely used (Bennett, 1975; Ehrmann, 1966). It is based on the assumption that each word has a general meaning which is always present whether the lexical item is in a context or in isolation. In context, however, overtones or context-specific features become attached to lexical items. This is a result of the concatenation of meanings of all of the words in the

sentence; their basic meanings interact and influence each other. This method of analysis ignores the context dependent learning process discussed in Chapter 1. It assumes that some a priori meaning is attached to every lexical item. The analyst does not have to consider carefully the similarities and contrasts between a set of related terms. Each lexical item is thought to be an independent entity and a system of relations among them is not taken into consideration. Ehrmann (1966) gave her justification for using this type of approach:

> It was my feeling before begining, and it is still my feeling that the idea of symmetrical or exceptionless semantic arrangments has been so appealing to students of the modal auxiliary system that they have tended to overlook arrangements which are less tidy but which perhaps correspond better to present day usage. (p. 9)

Her criticism was in response to the binary feature analyses like those of Joos (1964) and Marino (1973). The Gesamtbedeutung method, however, is not useful for psycholinguistic studies. It is based on the assumption that words and the meanings attached to them have an independent existence. The method does not recognize that lexical items have meaning because a community of speakers use them for communication purposes. The method cannot be easily adapted to determine the similarities and differences which language users perceive between sets of words. The componential method of semantic analysis combines the advantages of both binary feature systems and

Gesamtbedeutung; it is more general because it does not require a system of binary features, yet it does require the analyst to take a more disciplined approach since he must consider how a whole set of related terms interacts.

One of the major difficulties associated with a linguistic analysis of modals is that modals, except for can, do not take the tense inflections which are applicable to other verbs. The hypothetical meaning associated with the modal system blocks the use of grammatical tense. Past and Present tense inflections do not necessarily mean or refer to past and present time, but there is a strong correlation, especially for past tense, between tense inflection and the real world sequence of events. This correlation makes tense largely irrelevant for the modal system since in English it is strange to talk about a past time hypothetical event.

It may be that modals operate on a hypothetical system which differs from the tense system applicable to other verbs. The past-nonpast tense system is used for describing the normal sequence of events, while the modal or hypothetical system is used for events which are uncertain or have not occurred. The traditional eight modals could thus be considered descriptive of certain hypothetical 'tenses'. Will and shall are traditionally considered future markers, and future events are by definition hypothetical; may and can, on the other hand, might be considered markers of a 'possible tense' and must and ought

to could be markers of an 'obligation tense'. Indeed, in some languages such hypothetical tenses are reflected in the inflectional system. Japanese, for example, has verbal affixes for conditional, provisional, tentative, potential nonpast, and causative nonpast, to name only a few (Jorden, 1963, p.p. 360-361). All languages may have some syntactic devices for representing hypothetical propositions. Japanese uses its inflectional system to reflect hypothetical tenses, and English uses the modals for this purpose.

Although the past-nonpast tense distinction is not semantically applicable to modals, could, would, might, and should are considered by structural linguists such as Joos (1964) and Twaddell (1963) to be the syntactic past tense forms of can, will, may, and shall. This analysis creates problems, since the meanings of would, might, and should seem, to many linguists, to be very different from their supposed present tense counterparts. For example, Marino (1973) analyzed may as having the characteristic of permissibility (-necessity, +possibility, -execution), and might as having features for expressing the notion of implied negation (-necessity, -possible, -execution). These two lexical items contrast on the feature Possible which indicates that they are distinct lexical items. The modal pair can-could constitute the only exception to the generalization that modals do not have past tense forms. Could functions as the past tense variant of can in

sentences like the following:

3. Edward could run a mile yesterday,
but today he can hardly walk.

Can and could may both mean "to be able to do something," or they may be used to indicate that someone is granting permission for something. The other modals (will, would, shall, should, may, might) each have a distinct meaning. For example, shall indicates that some action will be performed, while should is used to indicate that an obligation is present. All of the modal "pairs" (e.g., shall-should) were historically tense variants but only can and could have retained a similar semantic identity and therefore still function as tense variants.

One approach to the characterization of tense in the modal system is to say that differences in tense signal differences in meaning. Ehrmann (1966) took this approach, saying that the nonpast-past pairs, such as will and would, had the same basic meaning but differed on the overtones that each carried. This implies that differences in tense do signal differences in meaning. This may be the case, but the difference in meaning between verbs like talk and talked is not of the same kind as that between may and might. The semantic distinction between talk and talked reflects a difference between a nonpast and a past event. Both of these verb forms agree with time adverbials which reflect the appropriate temporal context, (e.g., Fred talks to Anna today vs. Fred talked to Anna yesterday). There is a

semantic agreement between the verb tense and the time adverbial. This type of agreement does not always occur for modals. One can say, "He may come today," but *"He might come yesterday" is not an acceptable sentence. Might is thus analysed as formally past tense, but semantically it does not agree with the past time adverbial, in fact, it seems to have a futuritive connotation. The tense distinction between verbs such as, talk and talked reflects a simple difference of temporal reference, while the semantic difference between modals is more complex.

One might hypothesize that the normal past tense marker reflects a semantic distinction in the modal system which is not found in the indicative system. This would imply that will-would and the other nonpast-past modal pairs are related on formal grounds only; that is to say, that although they mean different things they happen to be morphologically related. This violates one of the tenets of morphological analysis which is that if two forms share the same morpheme they are related in meaning. The position taken here is that, although these forms are historically related, they are completely separate lexical items in modern English. It was hoped that in a semantic similarity experiment these forms would not be judged, by the subjects, to be semantically related.

There is some question as to whether or not the set of hypothetical verbs should be restricted to the traditional eight modals. A number of linguists (Ehrmann, 1966;

Twaddell, 1963) felt that dare and need no longer function syntactically as modals. When these two forms are used as modals in modern English they sound archaic and probably do not belong with the set of hypothetical verbs. Ought to is also marginal in its status as a modal. The set of modals has been determined by formal grammatical criteria and the semantic domain of forms which refer to hypothetical events is larger than the eight modals listed above. Leech (1969) used the componential method to analyze the modals. He noted that many of his proposed features could also be applied to nonmodal forms; for example, the features Permission and Obligation serve to contrast may and can with must, but these features can also be extended to verbs such as let, allow, permit, make, compel, and oblige (Leech, 1969).

There are other proposals for extending the set of hypothetical verbs. Twaddell (1963) defined a set of catenatives which was composed of 'decaying modals' such as dare, need, and ought and included other verbs which can appear before the infinitive form of a verb, for example, have to, want to, or be going to. Joos (1964) called these forms quasi-auxiliaries, although he denied that they had any connection with modals whatsoever. In the transformational-generative tradition there was also a proposal for extending the set of hypothetical verbs. Hakutani (1972) distinguished between verb phrases which arise from two underlying sentences and verb phrases which

are the result of a single underlying sentence. In the following set of sentences, for example, (4) is analyzed as coming from (4a) and (4b) both, but (5) is not derived from (5a) and (5b) because only one structure can underlie (5):

4. He is ready to go.
   4a. He is ready.
   4b. He goes.

5. He has to go.
   5a. He has.
   5b. He goes.

It appears that the semantic domain of hypothetical verbs can be extended, on the basis of both formal syntactic and semantic criteria, to include forms which are not strictly modals. These forms behave in a similar manner syntactically; they all appear before an infinitive form of a verb. They also modify assumptions about the occurrence of the event which the following verb refers to. In the present study the semantic domain of hypothetical verbs will include the traditional set of modals as well as some other verbs which share some of the semantic and syntactic characteristics of modals.

Prepositions

Prepositions are another class of lexical items which were traditionally considered grammatical or functional in nature. Gleason (1961) said that a preposition fulfilled all the requirements of an ideal function word.

> It should be a member of a relatively small constituent class with a fixed membership. Its occurrence in a corpus

> should be highly independent of the subject matter, literary type, or style. Any item approximating these qualifications is likely to be highly involved in structure signaling and easily recognized as such. (Gleason, 1961, p. 159)

Members of the class of prepositions are, however, not as easy to identify as Gleason implies. The set of prepositions is not small or closed in the same way that the class of determiners or modals is. Any individual would be hard pressed to list all of the English prepositions without forgetting a few or listing some forms that are considered to be adverbs by some grammarians. The categorization of adverbs, and the problem of confounding them with prepositions, will be discussed more fully below.

One objection to the structuralist's description of prepositions, exemplified by Gleason (1961), is that no distinction was made between a semantic and syntactic classification of prepositions. Neither method of classification is without problems. Prepositions exhibit a variety of syntactic behaviors. They usually occur with a noun phrase object but they may also occur as adverbials modifying a verb phrase. Sometimes a preposition occurs as a particle attached to a particular verb (e.g., John <u>called</u> Mary <u>up</u>). This type of construction is often described as a verb plus a following preposition but these forms perhaps may be more properly considered single lexical items, on the grounds that there are no criteria for determining which particle goes with a particular verb; <u>call up</u> is acceptable

but not *call above. Since the verb-plus-particle construction is considered a single semantic unit by most speakers of English, the particle attached to a verb will not be considered a member of the class of prepositions in this discussion even though such particles have the same lexical form as a subset of the prepositions.

Prepositions often behave functionally in a manner similar to verbs (Becker & Arms, 1969). Like verbs, prepositions determine a semantic relationship or link between two noun phrases. In particular, prepositions have objects and form prepositional phrases which have a syntactic structure similar to verb phrases (Noun-Preposition-Noun). Becker and Arms list a number of ways that prepositions resemble verbs. They can function as imperatives (e.g., Down, Spot!). They can be subclassified by the type of objects they take; stative prepositions having no object (e.g., John is tired out); motion prepositions having optional objects (e.g., John's out (the window)); and locational prepositions having obligatory objects (e.g., John's at the door). Becker and Arms also stated that motional prepositions can be replaced by stative verbs and that motional and locational prepositions have momentary and continuative features which are also characteristic of some types of verbs. Although prepositions have several verb-like qualities there are also important differences between the two classes; in particular, prepositions do not take verbal inflections.

Becker and Arms' analysis was based on an attempt to use prepositions as predicates in underlying structures and various rules were applied to downgrade the preposition from predicate status to its surface syntactic form. However, the type of syntactic theory which deals with underlying forms does not offer any enlightenment as to the semantic nature of prepositions and will not be considered any further here. The point being made is that prepositions have a much more complex syntactic behavior than is implied by labeling them as function words. Not only may prepositions function syntactically like verbs, but they determine a semantic link between noun phrases which is similar to that formed by verbs. Many prepositions and verbs have a similar semantic content, for example, pierce and through, or flee and from. This similarity of syntactic and semantic function indicates that verbs and prepositions may be less distinct than traditional structural linguistic accounts would suggest.

Another linguistic description which defined some of the relational properties of prepositions was proposed by Fillmore (1969a). He hypothesized that English prepositions are markers of the functional roles which nouns have. Fillmore observed that expressions such as "in the room, toward the moon, on the next day, in a careless way, with a sharp knife, and by my brother," contained "... the functional information that they are adverbials of location, direction, time, manner, instrument, and agent respectively"

(Fillmore, 1969a, p. 362). Fillmore wanted to develop syntactic representations which would show that these expressions were categorically prepositional phrases but at the same time would indicate what their function was. His theory, called Case grammar, was actually based on the real world knowledge that speakers have about objects. The functional role of a noun is determined by the meaning of the referent of the noun, and not by which prepositions are present. For this reason, Case grammar fails as a syntactic theory.

In his theory, Fillmore used underlying syntactic representations and he proposed that every noun phrase has an obligatory preposition in its underlying structure.

> I recognize, therefore, various categorially introduced noun phrase types - suggestive, it seems to me, of the traditional notion of "cases" - each, in English, beginning with a preposition. (Fillmore, 1969a, p. 365)

These prepositions in underlying structure were later deleted under certain conditions; for example, when the noun phrase appears in subject position. This deletion was often context specific, depending upon which noun was present. The deletion of underlying prepositions presents a problem for Fillmore's theory since it is difficult to justify the appearance of prepositions in underlying structure which must always be deleted at the surface. Another difficulty with Fillmore's theory was that the choice of which prepositions appeared in underlying structure was usually

arbitrary, although a small set of prepositions was associated with each specific case.

> Thus, the Objective preposition is _of_ if it is the only actant in the proposition or if the proposition contains an Instrumental or an Agentive; otherwise it is _with_. The Instrumental preposition is _with_ just in case the Agentive co-occurs: otherwise it is _by_. The Agentive preposition is _by_. (Fillmore, 1969a, p. 368)

Three cases of particular importance to a discussion of locative prepositions are the Locative, Source, and Goal cases. The Locative case is, "...the case which identifies the location or spatial orientation of the state or action identified by the verb." (Fillmore, 1968, p.25) It was probably necessary for Fillmore to propose such a case, since prepositions are often used to focus on the spatial location of an object. However, a simple Locative case was inadequate for describing the various uses of prepositions; many locative prepositions are used with verbs of motion. The combination of locative prepositions plus verbs of motion contributes a dynamic and directional meaning to sentences. Fillmore (1971) proposed the additional cases of Source and Goal to describe the dynamic aspect of verbs of motion. "Depending on the type of predicator, the Source and Goal are interpreted as earlier and later locations..." (p. 41). Fillmore stated that verbs of motion have underlying Source and Goal cases which indicate the manner or type of motion. The proposal of these two cases within the framework of Case grammar lends independent support to

the hypothesis that verbs of motion and locative prepositions have many semantic features in common.

Fillmore defined underlying cases as grammatical functions but he was, in fact, trying to make a syntactic description sensitive to semantic information. The underlying cases which he proposed were representative of the semantic roles the nouns played in a sentence. The problem with this proposal is that there are many more prepositions than there are case categories, so that each preposition cannot be representative of a unique case. One solution would be to allow only a limited set of prepositions in underlying structure. For example, at could always be used to indicate the Locative case no matter what the surface representation in the sentence. This proposal, however, is not feasible since a very complicated system of rules would be necessary to convert an underlying at to a surface in, on, here, etc.

When Case grammar first appeared it seemed very attractive as a descriptive system, but it was too limited in scope to be considered as a theory of syntax because it only dealt with one type of syntactic construction, prepositional phrases. In the context of the present discussion, however, it offers a unique description of English prepositions. As elements of the subjective lexicon, locative prepositions may be used to indicate the functional role of the objects designated by concrete nouns. The functional roles which prepositions determine,

may correspond to the properties underlying the semantic domains which prepositions cover. The Locative, Source, and Goal cases described by Fillmore (1968) would be likely to be properties of the locative semantic domain.

The final disadvantage of the traditional syntactic classification of prepositions is that the distinction between prepositions and adverbs is not at all clear, particularly in the semantic domain of locative expressions. The assignment of lexical items to either the class of adverbs or of prepositions is based on a poorly defined syntactic distinction. Semantically, there is one unified class of locative terms. Prepositions have been defined as a small closed set of words; it is, however, often the case that one of the members of this set appears in a sentence modifying a verb. The following example is taken from Hockett (1958):

> 6a. He walked along.
> b. He walked along the road.
>
> In the former sentence, along is a postposed attribute to a verb; in the latter, along has the object the road and the constitute is attributive to the verb. (p. 193)

Hockett (1958) avoided the problem of classification by defining a set of prepositonal adverbs; forms which may function both as prepositions and adverbs. The form was an adverb when it was stressed and had no following noun phrase complement. If the lexical item was unstressed and was followed by a noun phrase, it was considered to be a

preposition. Hockett did not recognize that 6a has an understood noun phrase object, since people must always walk along something. Whatever the status of along might be, maintaining a distinction between prepositions and adverbs is only a problem in a syntactic description. If a semantic domain is considered, the distinction is not critical; all locative terms belong to the domain of spatial markers regardless of their syntactic classification. Consequently, at the semantic level it is not necessary to separate prepositions from adverbs. Hereafter the members of the locative domain will be referred to as prepositions and this term will cover locative adverbs as well.

A semantic classification of the set of prepositions presents problems of a different nature. The two semantic fields most often associated with prepositions are the locative or spatial domain and the temporal domain. A single preposition may belong to two or more semantic domains; for example, at may be used to describe a location (e.g., at John's house) or a specific time (e.g., at three o'clock). The question which arises is whether there are two distinct words with the same phonological shape or a single lexical item which belongs to two distinct semantic domains. The meaning of a lexical item was defined in Chapter 1 to be the relationship it had to other terms in a specific field, but the implication was not meant to be that a lexical item can participate in only one set of relationships. Nothing in field theory excludes a lexical

item from belonging to two or more fields. A lexical item in a particular context evokes a specific set of relationships. Some linguists (Bennett, 1975; Geis, 1970) have approached this problem by proposing that prepositions have a general and a specific meaning, a system similar to the one used by Ehrmann (1966) for her description of the modals.

> The Gesamtbedeutung of an item is the general meaning that it has in isolation, or that is independent of the context when the item occurs in a particular utterance. In a given context the item appears to have a specific meaning (Sonderbedeutung) but this results from the contribution of the meanings of neighboring items. (Bennett, 1975, p. 10)

However, instead of attempting to describe two types of meaning, it is more in line with native speakers' perceptions of time and location as independent entities to acknowledge two distinct semantic domains, locative and temporal. Context will then determine which system of relationships is evoked. Some prepositions will be thought of as belonging more naturally to one domain or the other, but this is because of the context in which that item usually appears.

The present study dealt with the locative semantic domain. The unifying basis of this domain is the set of perceptual factors associated with objects and their spatial orientation (E. Clark, 1972; Cooper, 1968; Miller & Johnson-Laird, 1976). The major semantic function of locative

prepositions is to position objects in space; in particular, prepositions are used to relate two or more objects. In first or second language learning, people must master this system of spatial reference which varies from language to language. E. Clark (1972) found that children paid more attention to the inherent spatial properties of objects than they did to instructions containing specific prepositions. Young children (1;6 - 1;11 years) put an object in a glass even when they were instructed to put the object on the glass, but older children (2;6 - 2;11 years) were able to perform the task correctly. The reason for the errors seemed to be that there is a natural property associated with containers which leads children to assume that objects always go in them.

Prepositions are relational concepts and are used in response to how an individual perceives a given situation. This perception can be based on two different systems, the deictic system and the intrinsic system (Miller & Johnson-Laird, 1976).

> We will call the linguistic system for talking about space relative to a speaker's ego-centric origin and co-ordinate axes the deictic system. We will contrast the deictic system with the intrinsic system, where spatial terms are interpreted relative to co-ordinate axes derived from intrinsic parts of the referent itself (p. 396).

The intrinsic system is based on the observation that some objects have inherent properties -- front and back, for example. The front of a person is that part which contains

his sense organs and also faces the direction he moves in, and the front of a dresser is usually determined by where the drawers are. The front of these objects does not change as the speaker changes position, so they have an invariant front-back orientation for most individuals.

A deictic orientation depends on the location of the individual speaking. The speaker is his own reference point. Two individuals facing a plain cube at 90° from one another will determine different sides of the cube to be the front. This ego-orienation in space is crucial to an understanding of the semantic system underlying locative prepositions. One reason that children have difficulty interpreting instructions containing prepositions correctly, might be that they have not learned to use ego-orientated reference properly. They must learn to use themselves as a constantly changing reference point. The properties of physical objects remain fixed but spatial locations with respect to individuals change as the individuals change position. Children must learn to abstract certain properties from a situation which are invariant with respect to their own reference in order to understand prepositions.

The intrinsic system is based on the fixed properties of objects but it has its origin in how those objects are perceived. Dressers and people have fronts because of the usual orientation of speakers. Consider the example of a classroom: it has four walls and no inherent features of front or back, yet most people would agree on where the

front of the room is. The front of a classroom is determined by where the instructor usually stands. Even the instructor, who has a different orientation than the students, would agree that he is standing at the front of the room, because he has also had experiences as a student. It could be argued that for this reason a classroom has an intrinsic front, but the front is determined by the deictic orientation of a number of individuals, and is therefore not an intrinsic property of classrooms. There are probably very few objects which have a true intrinsic front-back orientation. Most seemingly invariant orientations are based on people's experiences with deictic reference.

Fillenbaum and Rapoport (1971) conducted an experiment using a subset of prepositions as stimuli. They assumed that the set used would be interpreted in the locative sense because this was the only property that all the terms had in common. However, subjects were not instructed to think of the terms as locatives. The experimental procedure was the same as that described above for verbs of judging. When the results were analyzed, six different clusters were found: Under, Over, Spatial Contiguity, In, To, and Outward clusters. The full list of members of each cluster is given in Figure 6, Chapter 4 (page 94).

Fillenbaum and Rapoport's results compared favorably with those of Clark (1968) who conducted a similar experiment. Although their groups corresponded to potential spatial orientation fairly well, Fillenbaum and Rapoport had

difficulty in making "... any general statements as to the kinds of properties governing intra-cluster relations" (Fillenbaum & Rapoport, 1971, p. 147). Fillenbaum and Rapoport did not consider the possibility that their difficulities in interpreting the results might be because they did not specify that the prepositions used as stimuli were to be considered solely in the locative sense. Although most subjects probably gave these prepositions a locative intepretation, a few of them could have been using the temporal system. Some subjects could have even seen two main subgroups, one temporal and one locative. Fillenbaum and Rapoport were more interested in experimental technique than in explaining their results, so, although their work was very thorough methodologically, they did not present an in-depth interpretation of their results.

Prepositions focus on certain features of the objects associated with them. The properties of the objects do not change, but a speaker chooses to concentrate on those properties which he feels are relevant for a particular context.

> The difference between <u>at the wall</u>, <u>on the wall</u>, and <u>in the wall</u> has nothing to do with the real dimensional properties of the wall but only with those dimensional properties which are uppermost in the speaker's mind. (Leech, 1969, p. 161)

In Leech's analysis, <u>at</u> has no relevant dimension, <u>on</u> is associated with one or two dimensions, and <u>in</u> focuses on two or three dimensions. Various analysts used other systems of

classification to establish the differences among these three prepositions, which are considered typical examples of locative prepositions. Geis (1970) used the characteristics of the following noun phrases to describe these three prepositions: at can only be followed by a noun phrase that specifies a point in space; the noun phrase following in must specify an area or expanse; and the object noun phrase of on must have a surface. Miller and Johnson-Laird (1976) defined the differences between prepositions in terms of domains of search for an object. The use of in suggests that an object with an interior is present (p. 385). For on "... the subdomain for search should be the region of the surface of the relatum" (p. 386), and the object of at "... should be less mobile and larger or more salient than the referents they locate" (Miller & Johnson-Laird, 1976, p. 389). Although these three descriptions are based on very different theoretical approaches, they all indicate that in highlights interiors, on focuses on surfaces, and at is a general locative. One should be able to extend these approaches to a description of the relationships among other locative prepositions.

The experimental results reported in Chapter 4 revealed properties that corresponded to one or another of the analyses discussed in this chapter. Properties underlying the verbs of judging appeared to correspond to Fillmore's role concepts. The hypothetical verbs were based on properties which described the likelihood of an event

occurring, and deictic orientation was important in the analysis of the locative prepositions. For each of the domains studied, the underlying properties chosen to describe a domain were those that appeared to be the most compatible, of all of the analyses reviewed in this chapter, with the experimental results.

CHAPTER 3

THE EXPERIMENT

Method

Stimuli. As was discussed above, the choice of lexical items to be included in a particular semantic set is a subjective decision. In any experiment dealing with a semantic domain, only a small subset of the domain can be investigated because the number of terms studied is restricted by the number of comparisons a subject can reasonably be expected to process in one experiment. The experiment reported here used the scaling method in which subjects were asked to rate the similarity of each term to every other term, and this meant that subjects could not rate more than 25 words in any one set.

In order to constrain the subjects' semantic interpretation of the terms used, each set was accompanied by a sentence frame. Every term in the set formed an acceptable sentence when it was inserted into the sentence frame for that set, and the sentence frame limited the semantic interpretation of the term to the intended one. This was particularly important for the set of prepositions, because the frame restricted the interpretation of the prepositions to their locative sense. Using a sentence frame thus had the advantages of both constraining the interpretation of potentially ambiguous lexical items and also of insuring that all of the terms in a given set were

constrained syntactically in the same way.

The subset of the verbs of judging used was selected from the terms studied by Fillenbaum and Rapoport (1971). However, since their experimental technique allowed for more terms than could be dealt with by the scaling technique, some of the items in the set they studied were eliminated. The scaling method is most useful for discovering the greatest differences in meaning between words; for this reason, one term was eliminated from those pairs judged to be most similar by Fillenbaum and Rapoport's subjects. The study reported here was designed to find maximum differences in meaning, because the semantic contrasts between lexical items in a domain determine how those words are used and understood by native speakers.

In addition, a few other words from Fillenbaum and Rapoport were not used for idiosyncratic reasons. Impute was eliminated because it was felt that subjects might not be familiar with it. Attribute and condone were not used because they did not fit into the sentence frame, "They ____ him". Condone in particular did not belong with this subset of terms since it is a word used for a judgement of an action not a person. A set of 21 terms was finally decided upon. A complete listing of this set may be found in Appendix A.

The use of a sentence frame further constrained the lexical items which could be used since each word had to fit smoothly into the same sentence frame. It was difficult to

find a frame which would not lend an affective connotation to the set. Some sentence frames considered for the verbs of judging were, "The father ___ the son", and "The judge ___ the defendant", but these frames might have led to a semantic intepretation that was biased by evaluative factors. The frame finally chosen was "They ___ him". This frame appeared to be emotionally neutral and had the added advantage that no inflection would be necessary for the verbs. The frame also served to limit the interpretation of these verbs to judgements about individuals and not about actions or events.

The set of hypothetical verbs was extended from the syntactically defined set of modal auxaliaries according to the criteria discussed in Chapter 2 (Hakutani,1972; Twaddell, 1963). All of the traditional modals (can, could, will, would, shall, should, may, might,) were included with the exception of dare which was felt not to have any hypothetical qualities in modern English. Need was included in the form need to and ought as ought to. All of these forms fit into the sentence frame "He ___ go". It was hoped that this might shed some light on the problem of tense in the modal system. The subset of hypothetical terms studied, contained 18 items which may be found in Appendix A. Some examples of the non-modal hypothetical verbs are gets to, wishes to, and is going to.

The set of prepositions used was also selected from those studied by Fillenbaum and Rapoport (1971). Again, one

term was eliminated from the pairs judged to be most similar by Fillenbaum and Rapoport's subjects. The final set consisted of 21 terms which are listed in Appendix A. The sentence frame "He ran ____ it" insured that subjects would deal with the locative rather than the temporal semantic domain. The sentence frame provided a more specific context for these lexical items than the context claimed by Fillenbaum and Rapoport (1971) since the frame added a motional or directional meaning to all of the prepositions used. Direction may be considered a sub-domain of the larger locative domain. The lexical items in and between were used by Fillenbaum and Rapoport (1971) as stimuli, but could not be employed in the experiment reported here. Between was not used because no sentence frame could be found which would accomodate all of the other terms when between was included. In was also not used as a stimulus since it would have an ambiguous interpretation even given the sentence frame. It was felt that into and within would cover the alternative interpretations of in.

Each set of terms was arranged into an upper-triangular matrix with the members of a set running across the top and down one side of the matrix. This made it possible for each lexical item to be compared with every other lexical item in a given set. The matrices were generated by a computer program which randomized the order of terms in a set so that every subject received a different ordering of lexical items. One matrix for each set is given in Appendix B.

Each subject was given a matrix from one of the three semantic sets. No subject participated in the investigation of more than one set. The subjects were instructed to find the pair of words in the set which was the most similar in meaning; this pair was to be given a rating of 1 (most similar). Next, they were to find the least similar pair, and it was given a rating of 9 (least similar). These two extremes were to be used as anchor points for the similarity-of-meaning scale. The subjects were then asked to rate all of the other pairs of words on the already established 1-9 scale, filling in the cells at the intersection of each pair of items. Subjects could use any value between 1 and 9, keeping in mind that lower numbers meant more similar and higher numbers were to be used for the words least similar in meaning. Ratings of 1 and 9 in addition to the initial anchor points were allowed.

Before begining the actual task, subjects were shown a completed sample matrix consisting of seven temperature terms ranging from freezing to boiling. In this way subjects could see how a set of related terms could be ordered along a scale. They were, of course, warned that the matrix they were to complete would not be as neatly ordered as the temperature terms, which have only one underlying dimension. Subjects were also given a one page summary of the full set of instructions. They could quickly refer to this abbreviated set of instructions if they had any questions while they were completing the task. A

complete set of instructions to the subjects may be found in Appendix C.

Subjects were allowed to take the matrices home to complete and were asked to return them as soon as possible.

Subjects

A total of 46 subjects participated in the experiment. Eighteen subjects completed the matrices for the set of modals, twelve for the verbs of judging, and sixteen for the prepositions. One of the preposition matrices was eliminated because the subject apparently reversed the scale midway through the task.

The subjects ranged in age from 18-28 years and were University of Alberta students enrolled in an introductory linguistics course. They were all proficient in English. The subjects were not paid or in any other way materially rewarded for their participation in this experiment.

Analysis

The completed matrices from each set were unscrambled and the terms put into the same order. For each set, the subject data was pooled so that an average rating was obtained for each pair of terms. These average values were data for Johnson's hierarchical clustering program (Johnson, 1967). The mean ratings for each pair of stimuli, as well as the standard deviations of each pair, may be found in Appendix D. The hierarchical clustering method analyzes

matrices of similarity measures and "... constructs a hierarchical system of clustering representations, ranging from one in which each of the n objects is represented as a separate cluster to one in which all n objects are grouped together as a single cluster" (Johnson, 1967, p. 242). By using the distance measures between objects, the hierarchical clustering process groups the objects into increasingly larger clusters. Each cluster is a combination of the clusters below it; when some objects have been combined into a cluster, that cluster is then treated as a single object at the next higher cluster-assignment level. This process continues until all clusters or objects have been combined into a single, large cluster.

The maximum method of cluster reduction was used to form the clusters. This method reduces the data so that the distance between a cluster and an object outside of the cluster is the greatest possible distance, as represented by the following formula:

$$d([x,y],z) = \max [d(x,z), d(y,z)].$$

In this formula, d is the distance between two objects; x and y are in the same cluster, while z is an object outside of the x,y cluster. The reason that the maximum method must be used is that objects within a cluster are not always equidistant to an object outside of a cluster, which would be the ideal case.

Once the data had been reduced to form clusters, the diameter method was used to determine the level or value of

clustering (see Johnson, 1967, for a discussion of the alternate "chain method"). The diameter of a cluster is the greatest distance between objects within a cluster. Ideally this distance should be as small as possible, since the smaller the distance between objects within a cluster the more cohesive the cluster is. The objective of this method is to maximize the distance between a cluster and objects/clusters outside of it and to minimize the distance between objects within a cluster. The diameter method is based on the maximum method of data reduction, in contrast to other methods for finding the value of clustering, which use the minimum distance or an average distance of objects within a cluster to some object outside of the cluster. The level at which two objects are clustered is called the alpha level (Johnson, 1967). For distance scores, small alpha values indicate that two objects (or clusters) are very similar, i.e., there is a small distance between them. The larger the alpha level the more dissimilar the objects are.

In addition to forming the clusters, a measure of the cohesion of a cluster was calculated to determine if "... these k points are actually significantly closer together than one would expect by chance" (Johnson, 1968). This statistic depends on two distance measures -- the mean distance between the objects within a cluster (inner distance) and the mean distance between each of the objects in a cluster and all of the objects outside of it (middle distance). The tightness of a cluster can then be measured

by a statistic which is calculated by the following formula:

$$\frac{\text{Mean middle distance} - \text{mean inner distance}}{\text{Standard error term}}$$

This statistic gives the analyst information about the compactness involved in the distance measures and is a measure of the distinctiveness of a cluster from all objects outside of it.

> Certainly, the extent to which the middle distances are larger than the inner distances gives one a reasonable measure of the tightness of the cluster. (Johnson, 1968)

Pillenbaum and Rapoport (1971) claimed to be using the cohesion score (which they called a z-score) as a measure of significance. Using Chebyshev's inequality, they calculated the critical value to be $z(.06) = 4$. The problem with their approach is that nothing is known about the distribution of this statistic except that it is non-normal. The critical level which they calculated seems to be very conservative, and Pillenbaum and Rapoport (1971) ignored it "... when no significant cluster ... [was] obtained or when their number ... [was] very small" (p. 34). In following such a procedure, Pillenbaum and Rapoport (1971) were not properly using the cohesion score as a test of significance. The cohesion score would be a test of significance if its distribution were known, but since it is not, the statistic should be used simply as a guide for determining which clusters are present. This was, in fact, the procedure followed by Pillenbaum and Rapoport (1971).

The decision about how many clusters are present should be based on a number of criteria, the most important being interpretability of the clusters obtained. In the absence of a test of significance, the clusters revealed by the analysis should make sense for the data set studied. Secondly, the interaction of the cohesion score with the level of clustering (alpha level) should be considered. The alpha level indicates the degree of similarity between two objects and is related to the variance within a group. If both the cohesion score and the alpha level are small values, one may conclude that no distinct cluster is present because, although the alpha level indicates that the two objects are similar, the low cohesion score means that they are not distinct as a group from all other objects in the set studied. In this case, a distinct cluster should be found at a higher alpha level. The combination of a low cohesion score and a large alpha level also indicates that there is no distinct cluster present. In this situation, the objects in the cluster are not very similar to one another and the group as a whole is not distinguishable as a separate cluster. A large cohesion score with a large alpha level means that the objects are not very similar although they can be identified as a distinct group. This situation should only arise when two fairly large clusters are being joined; it should not occur when two items are being clustered for the first time. In the former case, the two large clusters would probably be considered distinct and

would not be interpreted as one large cluster. The best possible situation is a large cohesion score and a low alpha level. This indicates that the objects concerned are similar to each other and that they form a cluster distinct from the other items in the set. In this case, there definitely is a distinct cluster. It may join a larger cluster at a higher alpha level, in which case it would be interpreted as a subcluster. A detailed explanation of how this type of analysis was applied to a particular example is given in the next chapter.

CHAPTER 4

THE EXPERIMENTAL RESULTS

This chapter presents the experimental results. The description of the properties underlying each of the semantic domains is based on the clustering of the lexical items in the hierarchical clustering solution. A graphic representation of the hierarchical clustering solution accompanies the discussion below of the results for each of the sets studied.

A general explanation of how these graphs were interpreted will be presented here. The diameter method (see Chapter 3) was used for clustering the terms in each set. In addition to the level at which items were to be clustered, the cohesion score was calculated for each link. The values on the left-hand side of each graph indicate the level at which a set of items were clustered together, with each item forming a single cluster at level 0. The level of clustering is an indication of how similar two objects were rated by the subjects. The value at the top of each link is the cohesion score for that link. The cohesion scores cannot be interpreted as absolute values since nothing is known about their distribution; however, they can be interpreted by comparing them with other cohesion scores in the same graph. For example, in Figure 4 (page 87), the hierarchical clustering solution for the hypothetical verbs, the cohesion between must and has to is 2.99; by adding

needs to to this cluster the cohesion is increased to 4.13. Furthermore, by adding ought to and should to the cluster, the cohesion score is increased to 6.37, which indicates that all five terms should be considered members of the same cluster. On the other hand, by joining the will, shall, and is going to cluster with the could, can, and gets to cluster, the cohesion is only increased from 3.69 to 4.18, not a very large difference compared to the increase in the score when needs to is added to the must, has to cluster. This would indicate that the two clusters should not be joined together and should be considered independently. Determining which clusters are present is, to a certain degree, a subjective judgement but the cohesion score served as a guide and helped to make this decision more objective than it might otherwise have been.

Verbs of Judging

The hierarchical clustering solution (see Figure 2, page 79) revealed four different clusters which might be labeled Accept, Forgive, Reject, and Disapprove. These four groups were then joined into two larger clusters, one containing positive evaluations (Accept and Forgive) and the other negative terms (Reject and Disapprove). This structure is apparent in Figure 2 which presents a graphic representation of the hierarchical clustering solution. The clusters revealed here corresponded to the clusters found by Fillenbaum and Rapoport (1971, 1974) which are listed in

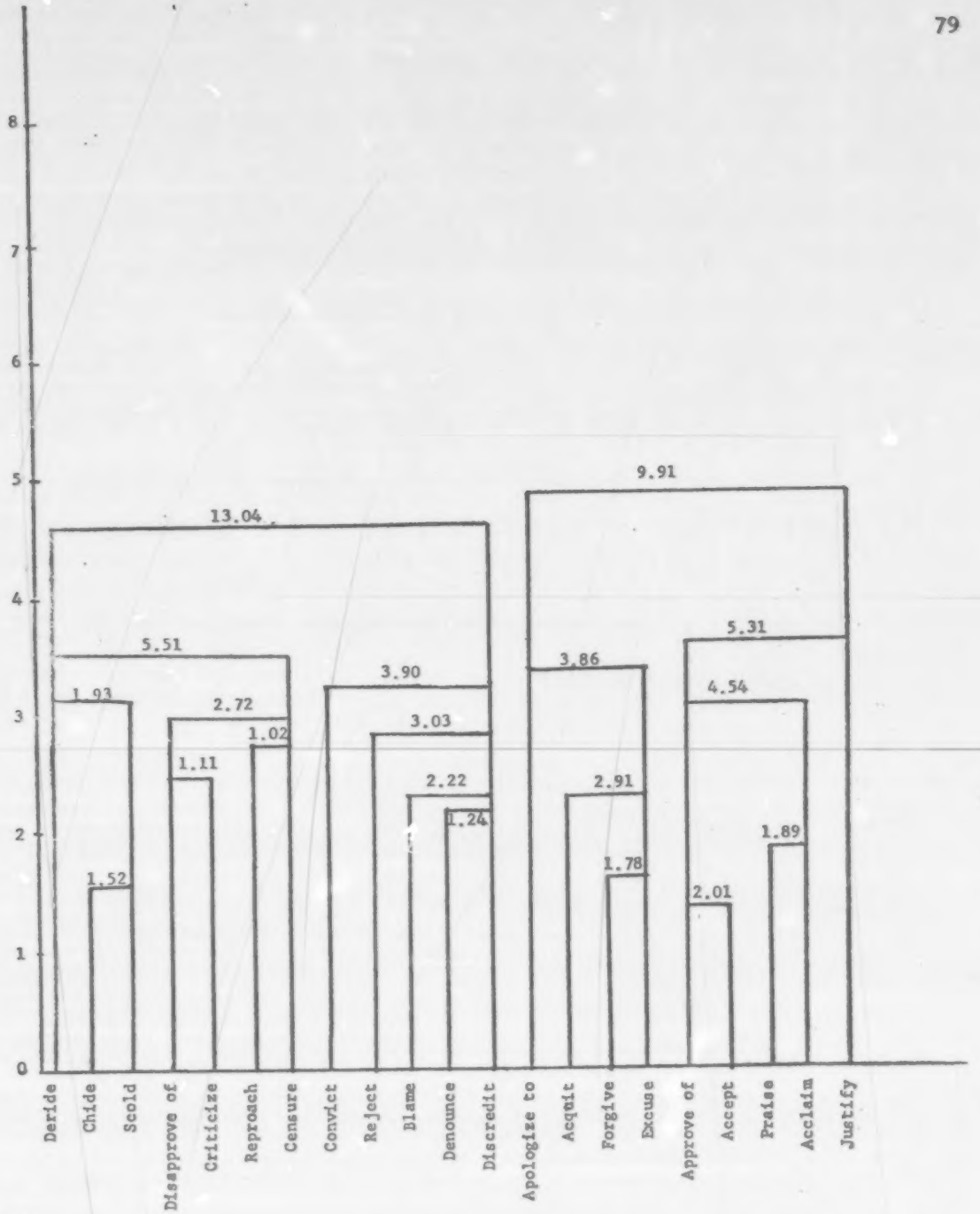

Figure 2: Hierarchical Clustering Solution for Verbs of Judging

Figure 3, (page 81). Fillenbaum and Rapoport (1971, 1974) claimed that their data fell into only three clusters instead of the four found here. Fillenbaum and Rapoprt's interpretation of the number of significant clusters present differs from that of the current author because they inconsistently used the cohesion score as a test of significance. They recognized two distinct clusters corresponding to the Accept and Forgive clusters but they only had one large cluster which corresponded to the Negative Evaluation group. Their decision was, however, arbitrary, and in their discussion they divided the latter group into two subclusters which corresponded to the Reject and Disapprove clusters. The use of the cohesion statistic as a guide, made the decision as to how many clusters were present less arbitrary than it otherwise might have been, and the present data clearly indicated that there were four distinct clusters, not three.

With respect to Fillmore's role features such as: Judge, Defendant, and Situation, all four of the clusters found could be analyzed in terms of presuppositions about (1) whether the actions of the Defendant were good or bad and (2) to what degree the Defendant will be held responsible for his action. With one exception, noted below, all of the items studied presupposed a Judge making some evaluation about the actions of a Defendant.

The Accept cluster (approve of, accept, praise, acclaim, justify) corresponded to Fillenbaum and Rapoport's

CLUSTERS FROM FILLENBAUM AND RAPOPORT (1974)

1. Admit-Forgive cluster ([*apologize, admit, confess] [*justify, *acquit, clear, *forgive *excuse, pardon])

2. Attribute-Praise cluster ([attribute, acknowledge, credit] [condone, *approve, *acclaim, commend, *praise])

3. Accuse-Condemn cluster ([*blame, accuse, charge] [impute, *chide, *convict, *scold, *censure, condemn, *denounce *criticize, *disapprove, *reproach])

CLUSTERS BASED ON FILLMORE'S RESPONSES (1974)

1. Admit-Forgive cluster ([confess, admit, *apologize, acknowledge] [*excuse, *approve, condone, *justify, *forgive, pardon])

2. Attribute-Praise cluster ([*praise, commend, *acclaim] [credit, impute, attribute])

3. Accuse-Condemn cluster ([*criticize, *disapprove, *blame, *chide, *scold, *reproach] [accuse, charge, *censure, *denounce])

Figure 3: Clusters obtained from two experiments conducted by Fillenbaum & Rapoport with verbs of judging. Starred items were also used as stimuli in the present experiment. Subgroups are set off by square-brackets.

(1971) Attribute-Praise cluster. All of the terms in the Accept cluster presupposed a good situation for which the Defendant will be held responsible. These terms all involved some form of praise or acceptance in the sense that the Judge has a positive evaluation of the Defendant's actions. The Accept cluster differed from the other three in that all of the items presuppose a good situation, the

other clusters all presupposed a bad situation but differ in the degree of responsibility of the Defendant. This cluster is tightly joined with a cohesion score of 5.31.

The Forgive cluster (excuse, forgive, acquit, apologize to) presupposed a bad situation for which the Defendant will not be held responsible. After the data were analyzed, the experimenter realized that apologize to differed from the other members of this cluster; it was the only term which did not involve a Judge-Defendant relationship. Apologize to is a word used when someone has carried out a self-evaluation, but this difference did not affect the results. The cohesion score when apologize to was added to the Forgive cluster increased from 2.91 to 3.86. This indicated that apologize to did belong to the Forgive cluster, and to apologize is, in fact, to ask for forgiveness for oneself. The salient properties for this cluster involved dismissing a Defendant from responsibility for a bad action. Perhaps with an analysis capable of detecting finer distinctions the difference between apologize to, and acquit, forgive, and excuse would be illuminated.

The Forgive cluster corresponded to the Admit-Forgive cluster of Fillenbaum and Rapoport (1971). The major difference is that justify was in the Accept cluster in the present experiment and in Fillenbaum and Rapoport's (1971) work it clustered with the Admit-Forgive terms. Fillenbaum and Rapoport (1971) noted that justify was one of the last terms to be clustered and they felt it should probably be

left as an individual cluster. The cohesion score change (from 4.54 to 5.31), however, indicated that in the present experiment justify did indeed belong in the Accept cluster. Subjects may vary as to whether or not they assign a negative evaluation to the use of justify; for some people this term presupposes a bad action for which the Defendant is seeking approval, but for others this verb does not involve any presupposition about whether the action was bad or good. The hierarchical clustering solution for Fillmore's responses (Fillenbaum & Rapoport, 1974) grouped justify with condone and approve. In this case, Fillmore's responses were in better agreement with the present results than were the results from Fillenbaum and Rapoport's (1971) earlier study.

The two Negative Evaluation clusters were distinguished by strong vs. mild disapproval. These two clusters corresponded to the subclusters of the Accuse-Condemn group determined by Fillenbaum and Rapoport (1971, 1974). The subclusters found in the analysis of Fillmore's responses (Fillenbaum & Rapoport, 1974) were more like the clusters found here; the Criticize subcluster corresponded to the present Disapprove cluster and the Accuse subcluster was very much like the Reject cluster. Both the Disapprove and Reject clusters presupposed a bad action for which the Defendant will be held responsible; they differ on the degree of responsibilty

All of the terms in the Reject cluster (convict,

reject, blame, denounce, discredit) are used to indicate strong disapproval or complete rejection of the Defendant by the Judge. There seems to be some notion implied that retribution will be expected from the Defendant and that he should recognize the wrongness of his action. The terms in the Disapprove cluster (censure, reproach, criticize, disapprove of, scold, chide, deride) all indicate a milder form of disapproval on the part of the Judge. The Defendant is not rejected and no retribution is expected. There is also no necessary implication that the Defendant should share the Judge's opinion and feel guilt. The difference between these two clusters might be expressed in terms of the Judge's actions; for terms in the Reject cluster the Judge asserts the responsibility of the Defendant for a bad action, and in the Disapprove cluster the Judge has a negative evaluation of the Defendant's action (Fillenbaum & Rapoport, 1974).

The clustering of blame with the Reject group differed from the results of Fillenbaum and Rapoport's study (1971, 1974) in which blame clustered with the mildly negative terms. This discrepancy might be due to the fact that blame has at least two different uses (Fillmore, 1969b). The two uses both presuppose a bad situation which has actually occurred; that is, they contain the presupposition that the Defendant is guilty. The difference between the two uses is that blame may either be used performatively to assert someone's responsibility or it may be used for the thoughts

of the Judge -- that is, the Judge thinks the Defendant is responsible but does not say so. This difference corresponds to the assertion vs. evaluation distinction proposed above. In both of Fillenbaum and Rapoport's experiments (1971, 1974) subjects were apparently using the evaluation sense of blame, while in the present experiment the assertion aspect of blame appeared more salient for the subjects.

It was gratifying to find that Fillenbaum and Rapoport's results were replicated by the present experiment, especially since the methods of data gathering were quite different. Some of the discrepancies between the present results and Fillenbaum and Rapoport's may be attributed to the fact that their subjects were forced to produce a linked tree and often apparently made an arbitrary decision as to how two subtrees should be linked. The method used here avoided this type of forced decision.

Fillmore's role categories were useful in analyzing the results of the study reported here. The important properties for the verbs of judging are: a Judge, a Defendant, some Situation which has occurred, and an evaluation of the Responsibility of the Defendant for the Situation. Fillmore's role categories of Judge, Defendant, and Situation appeared to be salient for the subjects participating in the experiment. The verbs of judging also carry a very strong good-bad evaluation. For this set of items the positive-negative dimension was very important and

was the overriding criterion for assigning similarity ratings.

Hypothetical Verbs

The hierarchical clustering analysis of the hypothetical verbs resulted in five clusters: Possibility, Futuritive, Permissive, Desiderative, and Obligation (see Figure 4, page 87). Each Cluster corresponded to one type of hypothetical event and the entire set formed a system of hypotheses.

Terms in the Possibility cluster (would, may, might) indicate that no physical force prevents some action or event from taking place, but there is some doubt that it will come to pass. This doubt stems not from external interference with the event but from uncertainty in the mind of the individual who is to perform the action. For example, in the following sentence, might indicates that no physical obstacles will interfere with John's ability to come but that he has not yet decided to do so.

7. John might come to the party.

Possibility terms are also used when the speaker is unwilling to commit himself to making a definite prediction about someone else's actions.

The Futuritive cluster (will, shall, is going to) contained terms used to make a positive prediction about some event, with the speaker asserting that there is 100% probability that the event will take place. Naturally, he

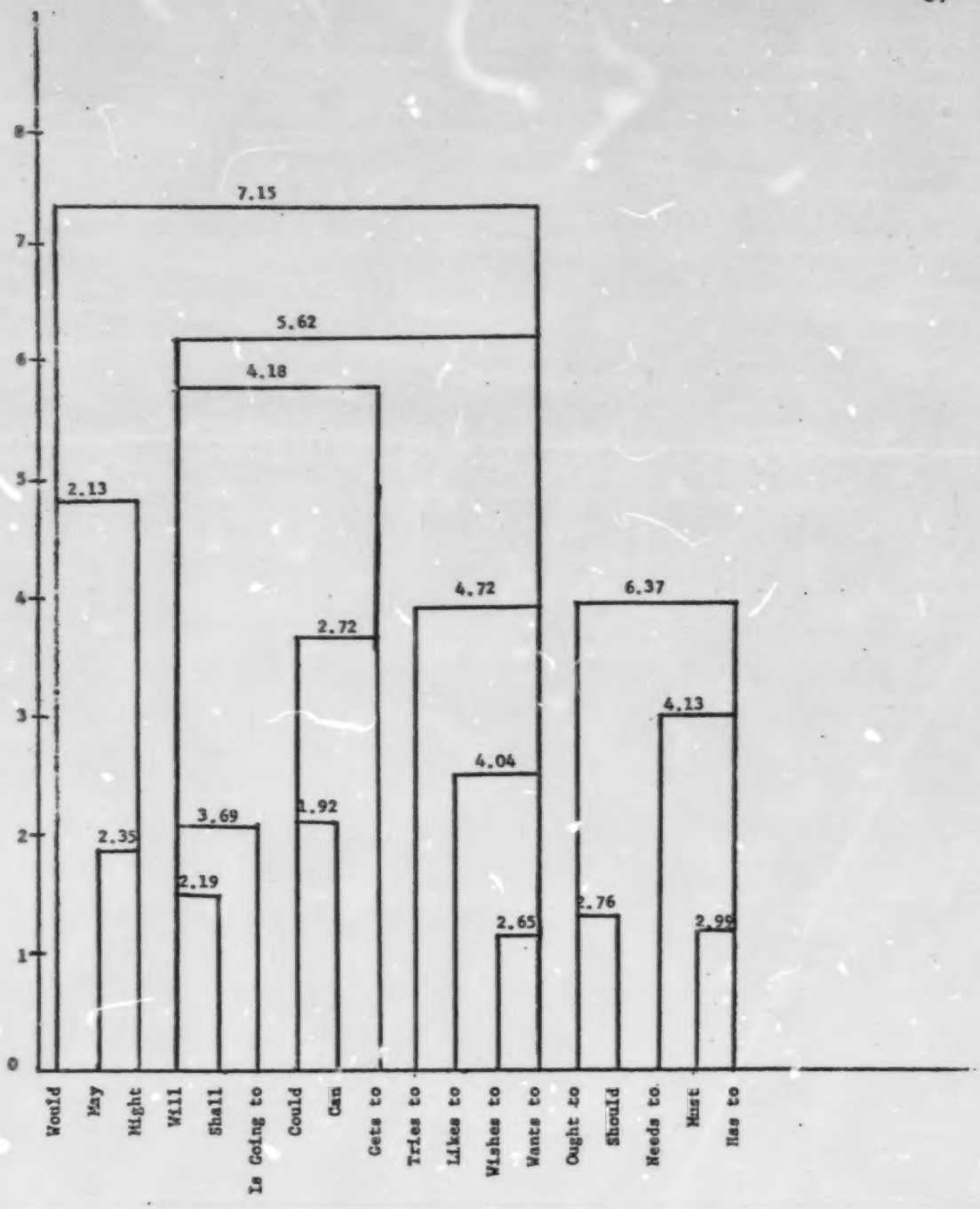

Figure 4: Hierarchical Clustering Solution for Hypothetical Verbs

could be mistaken, but when someone uses the terms from this cluster he is not hedging. The speaker is indicating that he is convinced that the unknown event will occur and that his hearers should take his word for it. The cohesion score for this cluster was 3.69 and indicated that the three Futuritive terms were very tightly linked together.

Terms in the Permissive cluster (*could*, *can*, *gets to*) indicated the existence of some external authority which allows the individual being discussed to perform an action. In addition to the premissive meaning, all of the terms in this cluster may be used to indicate the actor's skill or ability to do something. The two uses of the terms in the Permissive cluster are especially well illustrated by *can*, which is used in both of these senses. Consider the following example:

8. Ralph can drive.

The use of *can* indicates either that Ralph is being given permission to drive by the car's owner, or that Ralph is capable of handling an automobile. The present method of analysis was not able to distinguish between these two different senses of *can* because both are compatible with the notion that no obstacle, either internal or external, prevents the actor from performing some action.

May and *can* are often considered synonomous in the premission-granting sense, but subjects did not consider these two words semantically similar. In modern English *may* is losing its permissive meaning and is usually used as a

Possibility term.

The Desiderative cluster (tries to, likes to, wishes to, wants to) contained terms which are used to describe the internal state of the actor. The individual desires some event to take place but there is no guarantee that it will. The obstacles preventing the event from occurring may be external or they may be internal, induced by the mental state of the individual being discussed. The two types of obstacles are illustrated by (9), external, and (10), internal.

9. Fred likes to hike but his leg is broken.

10. Fred likes to hike but he's afraid of bears.

The last cluster, the Obligation cluster (ought to, should, needs to, must) has the salient property that the actor is required to complete an action. This cluster may be broken down into two subclusters -- one with a cohesion score of 2.76 containing ought to and should, and the other group containing the remaining three items of the Obligation cluster, with a cohesion score of 4.13. The use of ought to and should "... allows for the possibility that the constraining authority will be disobeyed" (Leech, 1969, p. 213). The other terms, needs to, must, and has to, imply that the individual has no choice about performing the required action. All of the terms in the Obligation cluster may also refer to the internal state of the individual being discussed, in the sense that it is up to him whether or not he meets his responsibilites. Needs to, must, and has to

indicate that he is under strong obligation to do so while ought to and should allow the individual some leeway.

The hierarchical clustering solution indicated that could, would, might, and should were probably considered by the subjects to be separate lexical items from their "present tense" forms can, will, may, and shall, although the evidence is not conclusive in every case. The cohesion scores for may and might (2.35) and can and could (1.92) were not large in comparison to the values obtained for other links in this set. Would and will, and should and shall did not even belong to the same clusters, so it is probably safe to assume that these 'tense variants' were considered distinct lexical items. Might and could are probably also independent lexical items, but since they were at one time the true tense variants of may and can respectively, they retain some similar semantic components.

Subjects did not treat the eight traditional (i.e., syntactically defined) modals differently from any other verbs in this set, indicating that the set of hypothetical verbs can validly be extended to include non-modals. Whatever grammatical differences exist between modals and other verbs, they did not affect semantic similarity judgements. This evidence supports the proposition stated in Chapter 2 that grammatical sets do not necessarily correspond to semantic domains.

The important semantic features for the hypothetical verbs were: some event being commented on, predictions about

the likelihood of this event occurring, and whether any obstacles were in the way. The obstacles preventing the event from occurring could be external or internal, stemming from the state of mind of the actor under discussion. Certain hypothetical verbs are also used when a speaker does not want to commit himself to a definite prediction about some event.

Prepositions

The hierarchical clustering solution for prepositions may be seen in Figure 5 (page 92). Eight clusters were found with two clusters containing only one item. These eight clusters generally corresponded to those found by Fillenbaum and Rapoport (1971) and also those found by H. H. Clark (1968), who conducted a similar experiment. The results from both Fillenbaum and Rapoport, and Clark are presented in Figure 6 (page 94). One of the major differences between the results of the study reported here and those of Clark (1968) was that antonyms (up-down) did not cluster together as they did in Clark's experiment. Antonyms may be grouped together as natural pairs, but not in terms of similarity. A problem with Clark's experimental procedure was that he did not instruct subjects to use a similarity criterion in their grouping judgements. He used 114 subjects who were told to group a list of 33 prepositions "... into anywhere from two to six groups, the groups that seem most natural to you" (Clark, 1968, p.

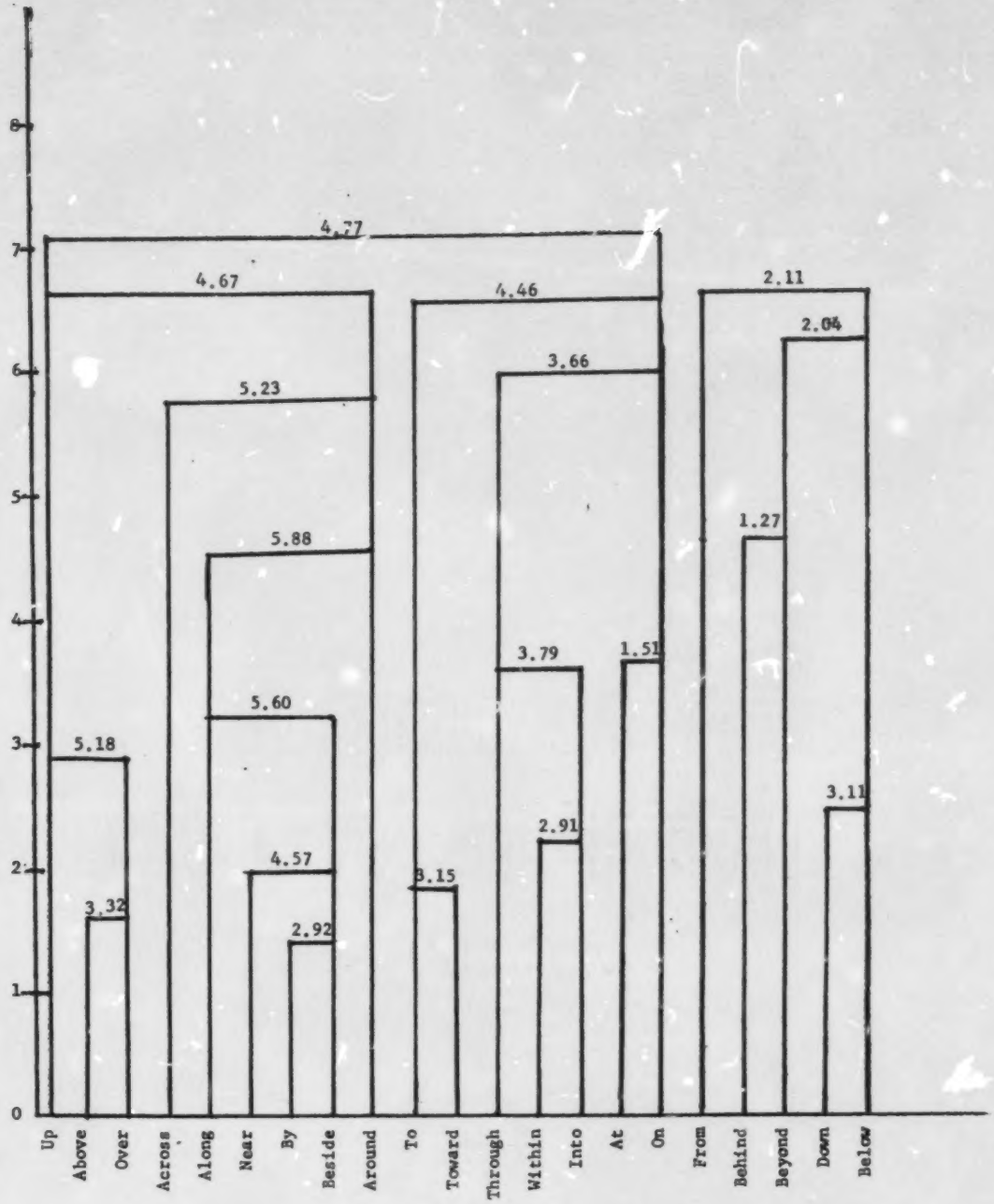

Figure 5: Hierarchical Clustering Solution for Locative Prepositions

423). Eighty-two of the subjects in his experiment also participated in a free-association task which preceded the grouping task. Antonyms are frequent responses in free-association tests, so it is highly likely that Clark's subjects were influenced by their previous free-association responses when they participated in the grouping experiment.

The remaining differences between the results of both Clark's (1968) and Fillenbaum and Rapoport's (1971) experiments and the present one may be due to the different manner in which similarity measures were obtained. In the present experiment each pair of items was rated independently of the rest. In both Clark (1968) and Fillenbaum and Rapoport (1971), subjects were asked to group the prepositions into 'natural groups', which meant that subjects were sometimes forced to make arbitrary decisions about which cluster a preposition belonged in. Another factor which may have influenced the results from these two experiments is that subjects were not told to limit their attention to a subdomain of the large set of prepositions. Both Clark (1968) and Fillenbaum and Rapoport (1971) assumed that the prepositions were interpreted in their spatial or locative senses. In the present experiment, the sentence frame directed the subjects into interpreting the stimuli locatively.

Although the sentence frame was "He ran ____ it", subjects interpreted He using a previously established ego-

CLUSTERS OBTAINED BY FILLENBAUM AND RAPOPORT (1971)

1. Under cluster (under, *below, *down, *behind)
2. Over cluster (*over, *above, *up, *on, *across)
3. Spatial Contiguity cluster (*beside, *by, *along, *around, with, together, among, *at, between)
4. Inward cluster (*to, *toward, *through, *into, in, *within)
5. Outward cluster (out, *from, away, *beyond, of)

CLUSTERS OBTAINED BY CLARK (1968)

1. under, *over, *above, *down, *up, upon, *on, off
2. inside, in, *within, between, among
3. outside, without
4. *around, *near, *along, about
5. *at, *by
6. *across, *into, *through
7. *to, *toward, *from
8. after, during
9. with, of, for

Figure 6: Clusters for prepositions obtained by two different experiments. Starred items were used as stimuli in the present work.

orientation. In consequence, Ego will henceforth be used to refer to the individual described by the sentence frame. Each of the prepositions represented a certain deictic orientation of an individual to an object. The object of

the preposition in the sentence frame is unspecified but subjects probably assigned the following properties to it: three-dimensional, larger than a person, and having a basic orientation in which Ego faces the front of the object. The object must be three-dimensional because humans usually relate to three-dimensional objects, although the perceived dimensions of the object may vary from preposition context to preposition context. It must also be larger than Ego because some of the locative prepositions position "He" inside of the object. The orientation on which the interpretation of the results was based is illustrated in Figure 7 (page 96).

The vertical dimension was highly salient for the subjects and was represented by two clusters, an Up cluster (up, above, over) and a Down cluster (down, below). These clusters indicated that, although the sentence frame set the prepositions in a locative context, subjects were not constantly referring to the frame when they were completing the rating task. "He ran up it" is not really similar in meaning to "He ran over it". The same holds true for down and below when they are inserted into the sentence frame. The strong influence of vertical orientation, which Miller and Johnson-Laird (1976) attributed to the effects of gravity, apparently masked the more subtle distinctions between these prepositions. The top external surface was the salient property of the Up cluster and the external bottom was the feature that the Down prepositions shared.

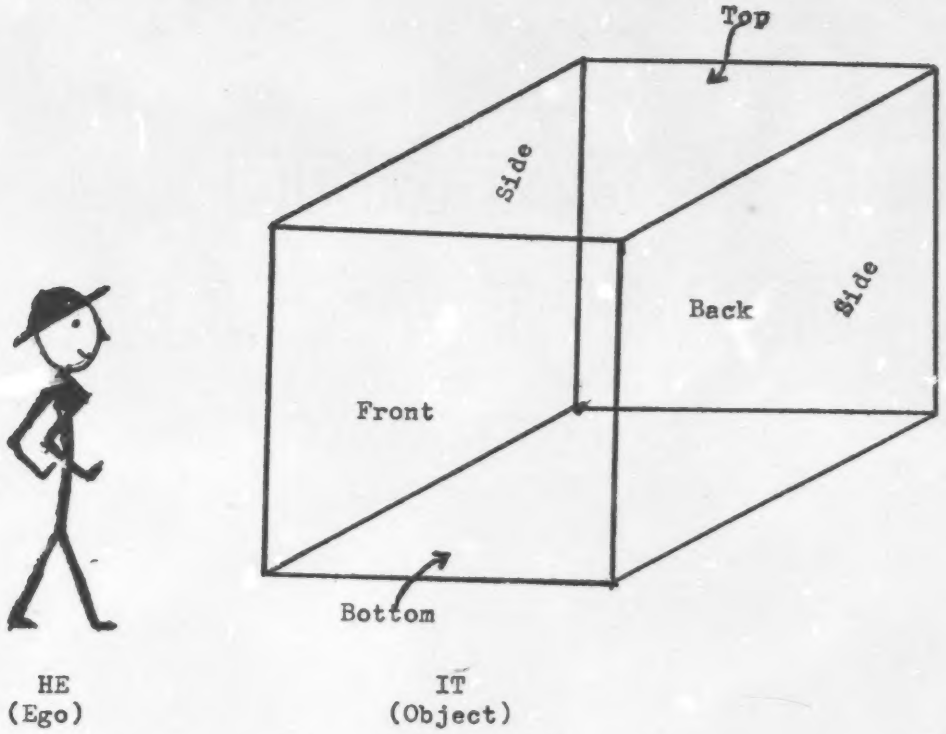

Figure 7: Basic orientation of an individual to a three-dimensional object

Contact with the surface of the object was not an important feature for either of these clusters. The Up and Down clusters corresponded to Fillenbaum and Rapoport's (1971) Over and Under clusters respectively.

Figure 5 revealed a cluster (to, toward, within, into, at, on) which appeared to correspond to Fillenbaum and Rapoport's (1971) Inward cluster, but the cohesion scores indicated that there were three distinct clusters. The salient property of the first cluster (to, toward) is forward motion. For this cluster the three-dimensional property of the object was not salient; the important factor was that there was some object in front of Ego. The basic orientation was not affected, since Ego was still facing the object as he moved closer to it.

The next cluster (through, within, into) located Ego inside the object. Direction or movement were not important properties for this group; into indicates entering and through implies exiting, but since these items clustered together with within, their directional properties were not highly salient. The important property of this group was the location of Ego in the interior of the object.

The last cluster (at, on) from this larger group also represented general location. The cohesion score for this group was not large (1.51) so the tightness of clustering was not great. The two prepositions in this cluster were general locative terms, the salient properties of the object being rather vague. Most of the linguistic analyses

discussed in Chapter 2 indicated that a surface is the salient property of an object when on is used, but the results reported here did not reveal this. There was, perhaps, no other term in the set similar enough to on to make this feature prominent. The low cohesion score for the clustering of these two items indicated that they may even have been clustered together by chance.

The cluster (across, along, near, by, beside, around) which focused on the sides or boundaries of the object corresponded to Fillenbaum and Rapoport's (1971) Spatial Contiguity cluster. Direction and movement were not important for this cluster; the salient property was the location of Ego with respect to one side of the object. Near, by, and beside imply spatial location at the external surface of the object, while around and along are used to indicate motion in a direction which follows the sides of the object. When across was clustered with the five terms discussed above the cohesion score decreased from 5.88 to 5.23. This indicated that across probably belonged in a cluster by itself. It focuses on the property of external surface but not the sides of an object.

The cluster (behind, beyond) contained terms which focused on distance from the object. These prepositions located Ego at a different orientation than the basic one; instead of facing the front of the object he is located somewhere away from the object on the opposite side from the front. There is no direction implied either for movement or

the way Ego might be facing. These two terms were also general locatives. The cohesion score for this group was quite low, 1.27, and these two items may have clustered together by chance, although they do seem to share the property of distance.

The last cluster contained the single item from. This term makes movement in a direction away from the object salient. Given the basic orientation depicted in Figure 7, from also implies movement out of the back of the object. In this respect from can be considered the antonym of the Forward motion cluster.

The meaning assigned to prepositions depended on the deictic orientation of the individual being discussed. The important features for the set of locatives studied are: (1) an individual who is oriented toward a point of reference, usually a three-dimensional object; (2) motion in a direction with respect to the object; (3) location with respect to the object; and, perhaps most importantly, (4) the vertical dimension. Prepositions also focused on certain aspects of three-dimensional objects; some properties of the object that were salient were: the external surfaces, internal surfaces, and boundaries or sides of the object.

CHAPTER 5

ORGANIZATION OF THE LEXICON

The Domains Studied

The type of experiment reported here was designed to detect the differences between terms in a set of lexical items which shared several properties. The experiment could not reveal any information about what all of the members of a set had in common. The assumption underlying this work was that all of the lexical items presented as a set were similar in meaning; that is, they belonged to the same semantic domain. In addition, the subsets of the semantic domains studied contained lexical items which were all members of the same syntactic form class.

In linguistic analyses such as componential analysis, semantic fields were usually determined which contain members of the same form class. When a set of items used for stimuli all belong to the same syntactic class any differences which might be due to syntactic factors are controlled for. However, this method of presentation is for experimental convenience. The psychological organization of the lexicon into semantic domains may cut across grammatical classes. Semantic domains are based on shared semantic properties and do not necessarily correspond to syntactic categories. The analysis of the results revealed properties which were salient for each of the three domains studied. These properties can be used to make predictions about other

members of a particular domain which might be from different form classes.

Verbs of Judging. The verbs of judging can be extended to include all terms involved in making evaluations about other individuals' actions. The semantic domain of Judging is divided into positive and negative evaluations. Apparently people's actions are viewed as being either good or bad. Other terms which may thus belong in the Judging domain are evaluative adjectives such as right and wrong, or guilty and innocent. The evaluative characteristic of the Judging domain is reflected in the fact that many terms in this set have antonyms, disapprove-approve, praise-condemn, moral-immoral, true-false, etc. Lexical items from other semantic domains most often do not have this property; bake from the domain of Cooking terms is negated by the particle not and there is no antonym meaning unbake. The positive-negative property appeared as a strong factor in the results obtained. It obscured any subtler distinctions which might have been revealed for the items investigated. If this experiment were extended, either all positive or all negative Judging terms should be used as stimuli. The analysis would then reveal the distinctions between items at one pole or the other, since the most obvious difference between Judging terms would be eliminated. One would expect both poles to be organized in a similar fashion, since antonyms supposedly differ only on the postitive-negative dimension.

Hypothetical Verbs. The semantic domain of Hypothesis has a different organization than the domain of Judging. In particular, there are no positive-negative poles. The important properties of this domain involve predictions about the occurrence of some event. The terms in the semantic domain of Hypothesis cover a range of definiteness from 100% probability that the event will occur to extreme doubt on the part of the speaker. Other terms which may belong to this domain are the adverbs probably, perhaps, possibly, and maybe. These adverbs are appended to a sentence to indicate that the speaker is unwilling to commit himself to a positive prediction. The conjunctions but, however, and if also add a hypothetical meaning to sentences and closely interact with the hypothetical verbs; when one of these verbs is used in the first clause of a sentence, the second clause often begins with but or if and qualifies the first, adding an explanation for the hypothetical nature of the statement. This sentence construction is exemplified by (9) and (10) in Chapter 4 (page 89).

Some of the important properties of Hypothetical terms are also found in other lexical items (Leech, 1969). The Permissive property of can, could, and gets to is also shared by verbs such as permit, let, and allow. Many other words share the Obligation property; compel, duty, and force are a few examples. Verbs such as think, believe, seem, and suppose are used as hedges when the speaker does not want to express a definite opinion. Know and fact share the 100%

probability feature with will, shall, and is going to. These are just a few suggestions; the properties revealed by the analysis of hypothetical verbs appear to be very general and apply to a large number of lexical items.

Prepositions. The semantic domain of Locatives functions completely differently from either of the other two domains. Terms in the locative domain focus on some aspect of the relationship between an individual and an object, or, alternatively, two inanimate objects. The Locative domain is probably subdivided into, (1) locative terms dealing with the relationship between two unmovable stationary objects, (2) terms dealing with two stationary but potentially mobile objects, and (3) locative terms dealing with the relationship between a stationary object and a moving or movable object.

The sentence frame used for the set of Locative prepositions set up a situation where the ego-orientated individual was the movable object and "It" was an unmovable stationary object. The groupings of prepositions which occurred focused on aspects of the stationary object. Speakers interpreted the prepositions from the point of view the moving individual. In the type of situation described by the sentence frame certain aspects of an object become more salient as the individual changed position. It would be interesting to redo this experiment, changing the sentence frame so that the ego-orientated individual is stationary and some object is moved; a possible frame would

be, "It moved ____ him". In this case the motional-directional properties of prepositions would be more prominent in the analysis. A sentence frame similar to the one given above would imply a very different basic orientation; the 'object' would probably have the property of being smaller than Ego rather than larger.

If any semantic domain appears to have a syntactic basis it would seem to be the Locative domain. This is reflected in the traditional notion that prepositions are pure function words with little or no semantic content. However, the results of the present experiment showed that prepositions do have salient semantic properties. Many of the properties salient for Locative prepositions are also important for other lexical items. The property of Orientation toward an object is relevant for posture terms (sit, stand, lie) and the property of direction is important for Verbs of Motion (cross, reach, pass) (Bennet, 1975). The verbs in the latter set are very similar to the prepositions over, toward, and near, respectively. It is possible that each locative preposition has a corresponding verb of motion which shares the same features. The adjective pair right-left definitely belongs in the Locative domain and is at the core of deictic orientation. Even the domain of Location can be expanded to include lexical items that are from a variety of syntactic classes.

Subject Strategy

Linguistic and situational context is important for correctly interpreting a lexical item. In this experiment subjects were asked to work with lexical items in a very minimal context. They had a sentence frame available to them, but this frame was itself presented in isolation. The results from the preposition set indicated that the subjects did not constantly refer to the sentence frames. The frames were useful for directing each of the subjects toward the same semantic domain, but evidence from the preposition experiment indicated that, when it came to making the similarity ratings, subjects judged the pairs of lexical items as isolated units. Subjects were probably basing their judgements on the most general meanings of the lexical items. They learned these general meanings by observing which kinds of contexts a lexical item could appear in; that is, how a word could be used. An experiment of the type reported here can never reveal all of the subtle uses of a word but it does offer information about the meaning of a word in terms of a statistical norm. In each of the three sets of rating judgements there was good agreement among the subjects, indicating that everyone understood the terms in a similar way.

The subjects were able to observe the similarities and differences between pairs of lexical items. It seems reasonable to assume that, in making their rating judgements, they must have extrapolated some common features

from the sets of lexical items used as stimuli. These features are not binary or as specifically defined as they would appear to be in the formal linguistic literature. Properties or presuppositions are perhaps better labels for the aspects of lexical items which the subjects were focusing on.

Linguists (Lyons, 1968; Palmer, 1976) have assumed that the lexicon is organized into semantic domains on the premise that all of the lexical items within a certain domain have some properties in common. The experimental results discussed in the preceding chapter indicated that different semantic domains may be organized differently. This suggests that the contention by linguists that all semantic domains have a hierarchic structure is not psychologically valid. A hierarchic organization can be imposed on almost any set of related terms, but language users may not deal with lexical items in this fashion. Psychologically, lexical domains do not have a fixed structure. The situational context in which a lexical item appears calls forth a particular organization for the domain that word belongs to. Therefore, the organization of a semantic domain may change in different contexts. The members of a particular domain are not fixed and, in some contexts, a term may move into a particular domain it would not ordinarily belong to -- as, for example, in metaphorical extension. Within a domain items cluster together on the basis of shared properties. Certain properties of lexical

items are made salient by the context in which those words appear. Therefore, within a domain, different clusterings may result from different contexts.

The organization of the lexicon being suggested here is a free-flowing, constantly changing clustering of lexical items. The clustering present at any one time depends on the situational and linguistic context. The underlying assumption is that the lexical organization evoked by certain types of contexts is similar for most individuals in a given speech community. This is possible because members of a speech community have shared experiences with similar types of contexts. This hypothesis would be empirically demonstrated if the kinds of organization revealed in this study changed as a function of variations in given situational or linguistic contexts.

Procedural Semantics

Up to this point, this discussion has centered on the organization of individual semantic domains. The investigation of semantic domains readily leads to speculation as to how various domains are interrelated, and, more importantly, how lexical information is accessed. The most common type of model of lexical retrieval is based on associative networks (Anderson & Bower, 1973; Miller & Jonnson-Laird, 1976). In this view, the lexicon has a hierarchical structure and each lexical item is connected by links to its superordinate term and also to the items it

contrasts with. The associative theory is similar to the network model described in Chapter 1. Lexical retrieval requires a search through the network in a manner similar to the way a computer searches its memory. Miller and Johnson-Laird (1976) have developed a version of this type of theory which they call procedural semantics.

> We can think of understanding a sentence as a form of information processing, as if the sentence were a program being fed into a computer. A listener, if he knows the language, has a variety of mental routines and subroutines that he can call and execute. (Miller and Johnson-Laird, 1976, p. 118)

This approach is very attractive since it allows the theorist to develop a highly formalized system for linguistic process, but there are many reasons why computer-type procedures cannot adequately represent mental processing of the lexicon.

The first objection is that such a procedural approach would be very time consuming. What Miller and Johnson-Laird (1976) were proposing was that sentences are processed one word at a time and the lexicon must be searched for the meaning of each lexical item. Then the lexical item must be broken down into its components or features. Once the meanings of individual lexical items are in "working memory" they must be integrated so that the meaning of the sentence can be understood. Neural activity would have to be incredibly fast for an individual to follow a discourse if he had to go through all of these steps in order to

understand one sentence. While the mind may indeed function rapidly, Miller and Johnson-Laird's theory depends rather heavily upon the physiological capabilities of the brain.

For efficient processing the mind must deal with the largest possible unit the individual can analyze and still comprehend an utterance. For example, a language user will only consider a sentence word by word if he cannot understand the whole sentence, and he will examine the feature components of a lexical item only if he cannot immediately comprehend the lexical item. Language processing might function in a manner similar to perception. In the visual perception of a photograph, for example, an individual sees the entire picture at once. If the scene portrayed is readily recognizable, no further analysis is necessary. However, if the photograph is abstract, making the objects represented unrecognizable, the viewer will pause and attempt to determine what objects were photographed. This same type of mental activity may apply to language comprehension. Decomposition and search will not be necessary if the individual can readily understand an utterance as a whole unit. Surely no complicated analysis is necessary for the comprehension of such rote phrases as "What's for dinner?". Listeners know right away what this phrase means, but procedural semantics would not treat it differently from more complicated discourses. Dealing with wholes is not strictly a linguistic process; individuals deal with all objects in their environment in this way. We

see a whole person, for example, before their eye color or clothing are noticed.

The second objection to procedural semantics is that it sets up a system which is too rigid as a model of the way the human mind works. In essence, procedural semantics assumes that the human mind functions like a computer. A computer can be programmed to produce output like that of a human mind (e.g., computers which "play" chess), but that does not mean that computers resemble human minds in their functioning. The assumption underlying the type of reasoning which assumes computers and human minds function alike, is that similar output is a result of similar processing. However, if carried far enough, the conclusion must be reached that a sophisticated computer processes language more like an adult mind than a child does, since the computer's ouput resembles adult speech more than the child's utterances do. Such a conclusion cannot be seriously considered, immature and adult minds have more in common physiolofically than either do with the mechanical functioning of machines.

Another assumption underlying procedural semantics is that the same sentence in the same situational and linguistic context will <u>always</u> evoke the same response. The nature of the search routines requires that the same context activate the same routines which are always processed in the same manner. However, human beings are flexible enough so that at different times they are likely to focus on

different aspects of the same situation. One might argue that 'different times' results in different contexts but this does not constitute a valid counter-argument since some procedural semanticists would argue that the same sentence evokes the same processes regardless of the context. A simple experiment could be constructed whereby subject's responses are measured in the same context at two different times. Unfortunately, in order for this experiment to be effective subjects would have to be made to forget the first occurrence of the situation, and there is no easily controlled forgetting device avaliable at the present time.

An Alternative Approach

The major problem with procedural semantics is that it treats the mind as a series of states with processes relating them. What I propose here is an approach to psychological phenomena which considers mind as a constantly functioning activity or variety of activities. What follows is a purely speculative discussion. The experimental results reported here do not support (or refute) any particular theory about the organization of the subjective lexicon. However, the mind-as-activity proposal seems as likely a candidate as any other theory of lexical organization. This approach is very difficult to conceptualize, perhaps because the world seems to be organized into a series of fixed states. The tendency of most individuals is to observe one state and, at some later

time, a different state. No one has actually observed a plant growing, but people do notice that as time passes the plant gets larger. However, the plant is not at a series of states with growing in between, it is always in the process of growing. The same is true of the mind; it is always active, but humans only observe its outputs at fixed points in time. The mind-as-activity approach to mental processing should be considered for all types of mental activity, but will only be exemplified here by lexical retrieval since that is the main topic of discussion.

The mind-as-activity proposal, which is not yet well-developed enough to be called a theory, does not lend itself to highly formalized routines but it offers a better explanation than procedural semantics of the highly creative and flexible nature of the human mind. People appear to have no difficulty communicating using language; therefore, a theory which hypothesizes immediate access to the language process seems the most desirable. This immediate access to linguistic functions might be based on perceptions of linguistic and situational contexts in which utterances appear. The mind-as-activity proposal presupposes a direct connection between perception and language. The complicated intermediary processes expounded by procedural semantics are no longer necessary.

One's language and culture interact to impose an organization on perceptions. This statement is very similar to the Sapir-Whorf hypothesis of linguistic relativity with

one important difference; humans are not bound by the way their perceptions are organized. They have the mental flexibility to explore and analyze perceptions in a unique manner, but the thinker must have the ability to transcend the mental constraints which culture and language impose. The geniuses of a culture are those individuals who are capable of perceiving the world in a new and different manner.

The organization of perceptions is necessary, however, so that humans are not forced to constantly analyze insignificant details when they are performing some task. Language directs an individual to focus on the salient aspects of a situation. This point is clearly illustrated by an experiment conducted by Glucksberg and Weisberg (1966). Subjects were given a candle, a box of tacks, and a book of matches. They were instructed to attach a candle to the wall so that it "... burns properly, and does not drip wax on the table or floor" (Glucksberg & Weisberg, 1966, p. 662). In order to solve the problem correctly, the subjects had to view the box as a possible candle-holder and not merely as a container for the tacks. When each of the objects were clearly labeled; box, tacks, candle, and matches, it took an average of 0.61 minutes to find the solution. Subjects could see that the box might be used as a candle-holder because it was labeled as a distinct object from the tacks. On the other hand, when no labels were present, the average time for solving the problem was 8.82

minutes. The longer response time occurred because the subjects were not able to perceive the box as an object independent of the tacks; rather they continued to view the box as a tack-container. Glucksberg and Weisberg (1966) concluded that "providing S with the verbal label of a functionally fixed object makes the object available for use..." (p. 663). The results of this experiment indicated that linguistic labels are useful in organizing perceptions of the world.

Miller and Johnson-Laird (1976) pointed out that people cannot refuse to understand sentences in their own language. People can pretend not to comprehend, but the sentence was processed whether they willed it or not. Miller and Johnson-Laird (1976) attributed this phenomenon to the automatic compliation of incoming utterances, but this observation about human languages offers strong support for the mind-as-activity view, which assumes that when a lexical item enters the system it automatically evokes the correct set of properties. In this type of system it would not be necessary to translate speech into higher mental languages or search-and-find subroutines.

The situational and linguistic context automatically activates certain domains of the lexicon so that a language user can immediately access the lexical item he needs, just as most people know exactly where to find items in their kitchen. If the cook wants to use a particular knife, he knows exactly where to find it, but prodedural semanticists

would have him searching the entire house for the knife. Even if the knife has been misplaced, no one would look in the freezer or flour cannister for it, since these are unlikely places to find an object like a knife. If people misplace an item they can limit the domain of search to the most likely areas. Comprehension of lexical items may work in the same way. The context automatically evokes the proper semantic domain just as the area of search was delimited. In this way, people can utilize the lexical items which are appropriate for a particular context.

A modified version of procedural semantics might be an adequate representation of a theory of language acquisition. Children perhaps learn words by observing their uses and comparing features of the situation with features already in the lexicon. The search-and-find routines would be necessary for developing semantic domains, but once the meaning of a word was learned it would no longer be necessary to search for it. When a word automatically evokes the proper configuration of properties in a particular context, an individual can be said 'to know' the meaning of that word. Of course, there is no set configuration of properties, it may vary from individual to individual. When a lexical item is properly used in a particular context, communication procedes unhampered. Words must be used in such a way that people get their intended messages across.

An individual knows which lexical items to use in

certain contexts because he knows the properties which contribute to the meaning of those words. These properties are seen as a whole unit and are not examined individually unless some aspect of the situation requires it. Which lexical domain is accessed will depend on how the speaker perceives a particular context. Consider the following situation:

> Hilda observes Alfonso and Frank together. Alfonso has written a letter and something in its contents has caused Frank to become extremely agitated. He is yelling at Alfonso.

The context will immediately activate the domain of interpersonal relations since the important aspect of this situation is two interacting individuals. If Hilda wishes to describe this event to someone else she may focus on different aspects of the situation. If she is sympathetic toward Frank she will concentrate on his emotional state and describe the situation by saying that Frank is upset, angry, furious, etc. If Hilda is more concerned with Frank's evaluation of the situation she will use one of the verbs of judging and say that he criticized, blamed, condemned, etc. Alfonso for writing the letter. Both verbs of judging and emotion terms are appropriate for this context. Hilda's perception of it will determine how she describes the situation to someone else. Miller and Johnson-Laird (1976) proposed procedural semantics as an intermediary link between language and perception. The mind-as-activity approach speculates that this link is direct and that a

complicated intermediary system is not necessary. Understanding language, either written or spoken, is a form of perception and language production is a way of expressing perceptions of the world.

The major criticism that procedural semanticists would probably level at the mind-as-activity approach is that it does not offer any formal apparatus for information storage and retrieval, it simply says "you know what you know." However, mind-as-activity does not necessarily imply rationalist philosophy. It should be possible to develop empirically determined theoretical constructs for describing the activities of the mind that are equal to those presently avaliable for describing mental states. One possibly fruitful area would be further development of the idea that language comprehension is a form of perception. Psychologists have learned a great deal about perception, and some perceptual phenomena might be extended to a description of linguistic processes.

For many years, language has been considered a unique type of mental activity. However, there is no reason to suppose that language functions differently from other psychological phenomena. Language production would be more difficult to deal with (as it is in most theories of linguistic abilities) because it is difficult to devise experiments for studying production. Psycholinguists have concentrated on comprehension, probably because it appears to be more 'passive' and therefore the subjects have

supposedly less to do than they do in tasks dealing with production. Mind-as-activity would consider comprehension and production as equally complex processes, but perception studies seem tailor-made for the further development of a mind-as-activity comprehension theory.

Further Research

The experiment performed here does not shed any light on the mind-as-activity vs. procedural semantics approaches. It reveals, however, the properties which people find salient for a subset of lexical items from the same semantic domain. An extension of this experiment, aside from applying the experimental technique to the study of other semantic domains, would be an investigation of how domains are acquired by children. Presumably the core or central terms are learned first and the domain is then extended as the child learns to make more subtle distinctions. It is unlikely that a child learns the complete configuration of properties all at once. Children probably learn a few properties of a lexical item at a time by observing the different uses of that word.

Very young children would not be able to complete a semantic similarity matrix of the type used here, but there are a couple of alternative methods for obtaining similarity measures from children. One method would be to use triadic comparisons. With this technique the stimuli are presented in sets of three and subjects are asked to choose the two

words which are most similar in meaning. A distance matrix can be constructed from the responses to all possible triads. This method is time consuming, and the attention of children is limited, so that only a small set of stimuli could be studied in any one experiment.

A more efficient method would be to present pairs of words and ask children to rate them on a 3 point scale: yes (the words are similar in meaning), no (they aren't), and I don't know (if they are similar or not). From the responses on this 3 point scale a semantic similarity matrix could also be developed.

A developmental study would also involve much trial and error to determine which lexical items are part of a child's vocabulary. A child of five might know the Judging terms blame, scold, praise, and good-bad, but would not yet have acquired acquit, deride, or justify. Semantic stages could no doubt be determined at which a child understands a subset of lexical items but does not know items which are understood by children at the next higher stage.

Summary

The work discussed in this thesis was based on two important assumptions: first, that the subjective lexicon is organized into semantic domains; and second, that the meaning of a lexical item is similar for most individuals in a given speech community. Psycholinguistic experiments, and indeed all language communication, are only possible if the

second assumption is true. Language users learn the meaning of lexical items by observing how those words are used in situational and linguistic contexts. Although each person has unique experiences, the meanings attached to words cannot be idiosyncratic. If this were the case, human beings could not communicate with one another. The contexts in which lexical items appear must be similar enough across individuals so that a common meaning for a lexical item is prevalent throughout a speech community. The results of the semantic similarity experiment were consistent for most of the subjects, indicating that this type of experiment can tap the general meaning core of lexical items.

Semantic domains cover large areas of meaning. All of the lexical items within a particular domain have some shared properties, which delimit the semantic field. At the same time however, they contrast on other properties. The interaction of similarity and contrast relationships between lexical items is the organizing principle of the subjective lexicon. The experiment discussed above concentrated on the contrastive meaning relationship between lexical items.

The notion of semantic fields was originally a formal linguistic construct. In the linguistic theory, fields were thought to have a strict hierarchic construction. All of the lexical items at one level of the hierarchy contrasted with each other but could not contrast with words at other levels. This rigid hierarchic structure was considered unworkable as a hypothesis about the organization of the

subjective lexicon. Therefore, the notion of semantic field was extended to include all terms having some common properties.

The pattern of a particular domain would be determined by the nature of the lexical items belonging to it. The purpose of this thesis was to determine the internal structure of three semantic fields: verbs of judging, hypothetical verbs, and locative prepositions. Some of the work previously performed by linguists and psychologists in these three fields was considered in Chapter 2. That discussion presented an overview of several of the meaning properties which might be relevant for these domains. The experimental results reported here did not conflict with any of the previously hypothesized features and generally added new information about the three domains. Each field seemed to have its own organization: verbs of judging have a dimensional organization with a dominant good-bad dimension; the important properties for hypothetical verbs dealt with the probability of some event occurring; and the relevant attributes of the locative prepositions were concerned with the orientation of some individual toward a three-dimensional object. The vertical dimension was also highly salient for this last domain. The assignment of a lexical item to a particular domain is based on semantic not syntactic criteria. In some areas these two factors may interact but, generally, they function independently so that a semantic field may contain words which are members of

different grammatical categories.

Linguistic and psychological methods are highly compatible in the area of lexical studies. Each discipline complements the other. Linguistic techniques are useful for determining which features are shared by a set of lexical items, while psycholinguistic experiments of the type reported in this thesis reveal information about the properties which are contrastive. Componential analysis is a procedure for assigning lexical items to a semantic domain. The decision about which terms belong in a particular domain are intuitive but there is usually enough agreement among linguists to allow a valid set of stimuli to be chosen. The experimental technique of semantic similarity measures enables the researcher to study native speakers' judgements about the similarity of meaning of the words from a particular domain. Similarity judgements can be solicited with a variety of techniques: scaling, association, substitution, and classification. Each method has its advantages and disadvantages. The scaling technique was used in the experiment reported here because its advantages seemed to outweigh its disadvantages. The main benefit of this method is that each subject rated the similarity of every possible pair of lexical items used as stimuli. The technique was highly successful for this type of study.

Experimental procedures such as semantic similarity ratings only indicate the types of tasks native speakers are

capable of performing; they do not necessarily reveal how language is actually processed. It is not a natural language task to compare pairs of words for the purpose of determining how similar in meaning they are, but the information for performing this task must be avaliable to language users. In the case of the semantic similarity ratings, the subjects were probably comparing the properties associated with lexical items. Their ratings were based on the overall impression they had of the differences between the stimuli. The nature of the task required such an approach. But this does not mean that lexical items are atomized in normal language processing. Language users must deal with lexical items as conglomerates of properties. The properties were necessary for learning lexical items and are always avaliable for particular tasks. Semantic similarity experiments reveal the underlying properties which lexical items have and how particular semantic domains are organized.

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APPENDIX A

LEXICAL ITEMS USED AS STIMULI

Verbs of Judging

Deride	Reject	Disapprove of
Chide	Blame	Apologize to
Scold	Denounce	Approve of
Censure	Discredit	Accept
Criticize	Acquit	Praise
Reproach	Forgive	Acclaim
Convict	Excuse	Justify

Hypothetical Verbs

Will	Shall	Is Going to
Would	Should	Wishes to
Can	Must	Wants to
Could	Gets to	Ought to
May	Tries to	Needs to
Might	Likes to	Has to

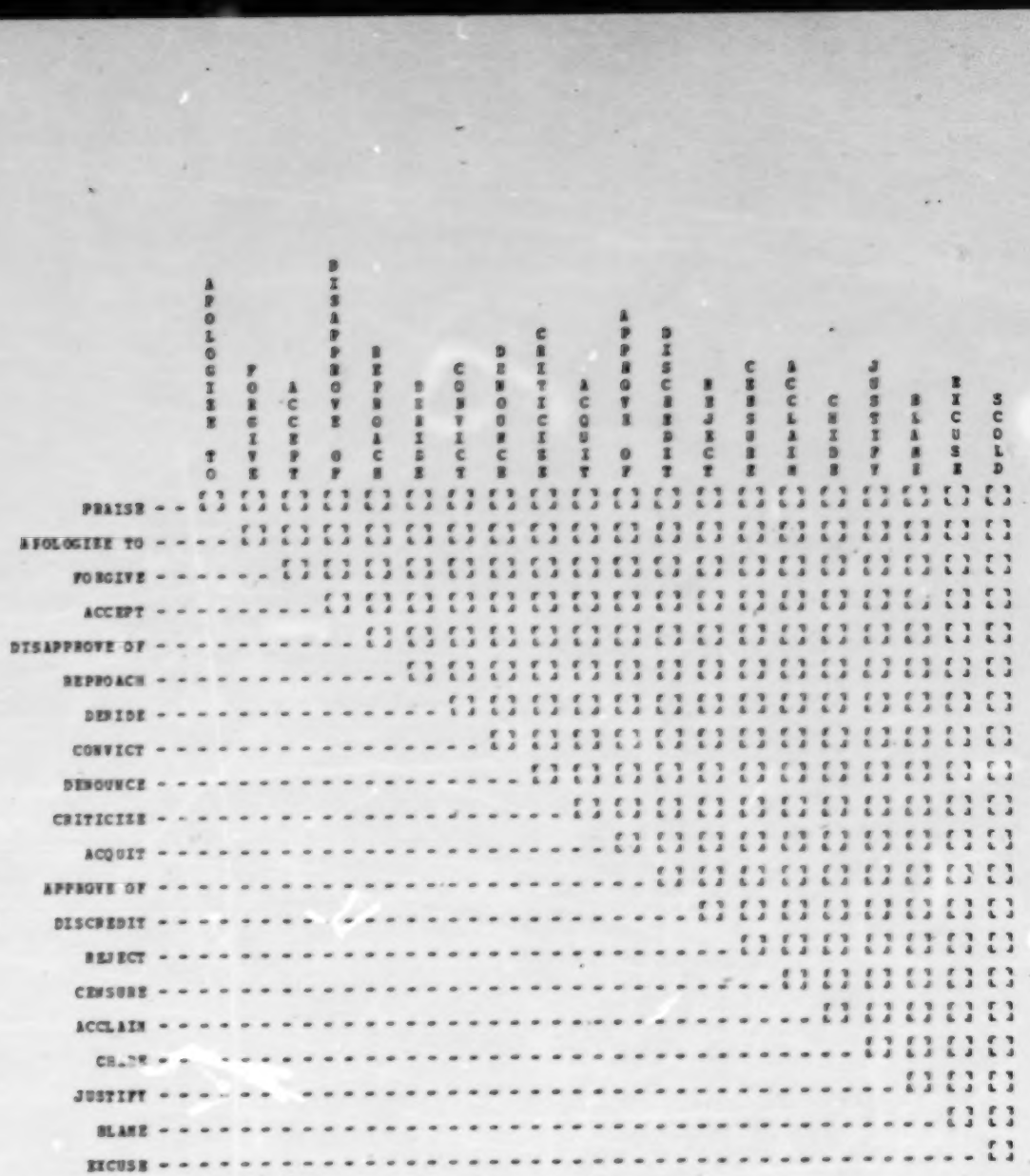
Prepositions

Up	Beside	At
Above	Around	On
Over	To	From
Across	Toward	Behind
Along	Through	Beyond
Near	Within	Down
By	Into	Below

APPENDIX B

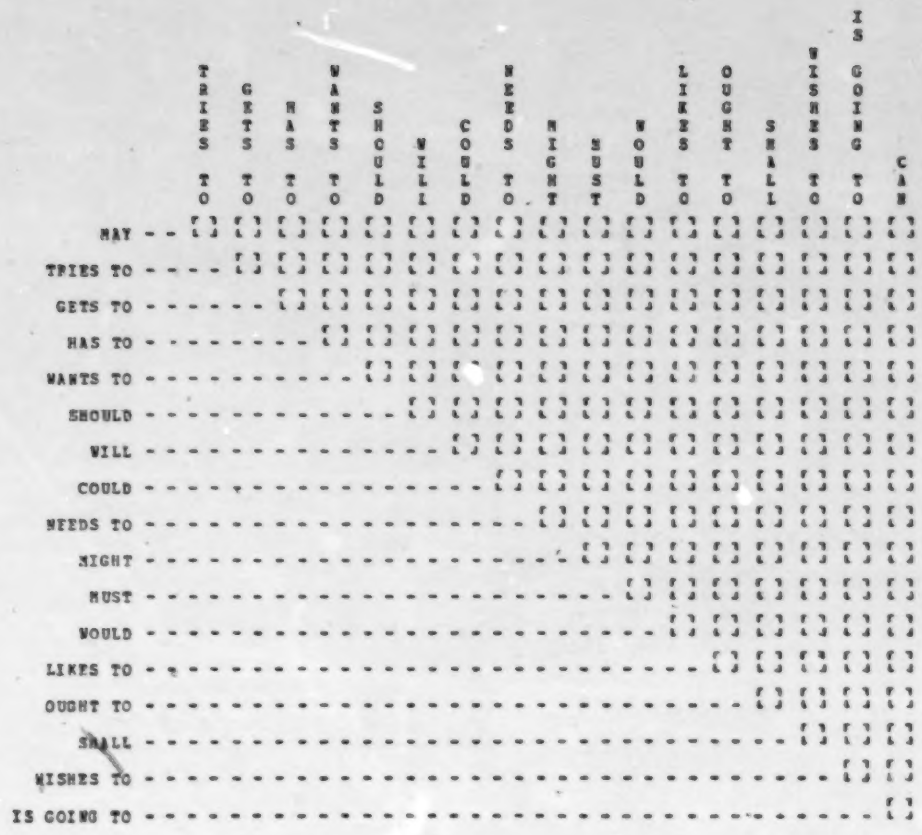
SAMPLE MATRICES

On the three subsequent pages there is a sample matrix from each of the sets studied. The presentation order is as follows: Verbs of Judging, Hypothetical Verbs, and Locative Prepositions.

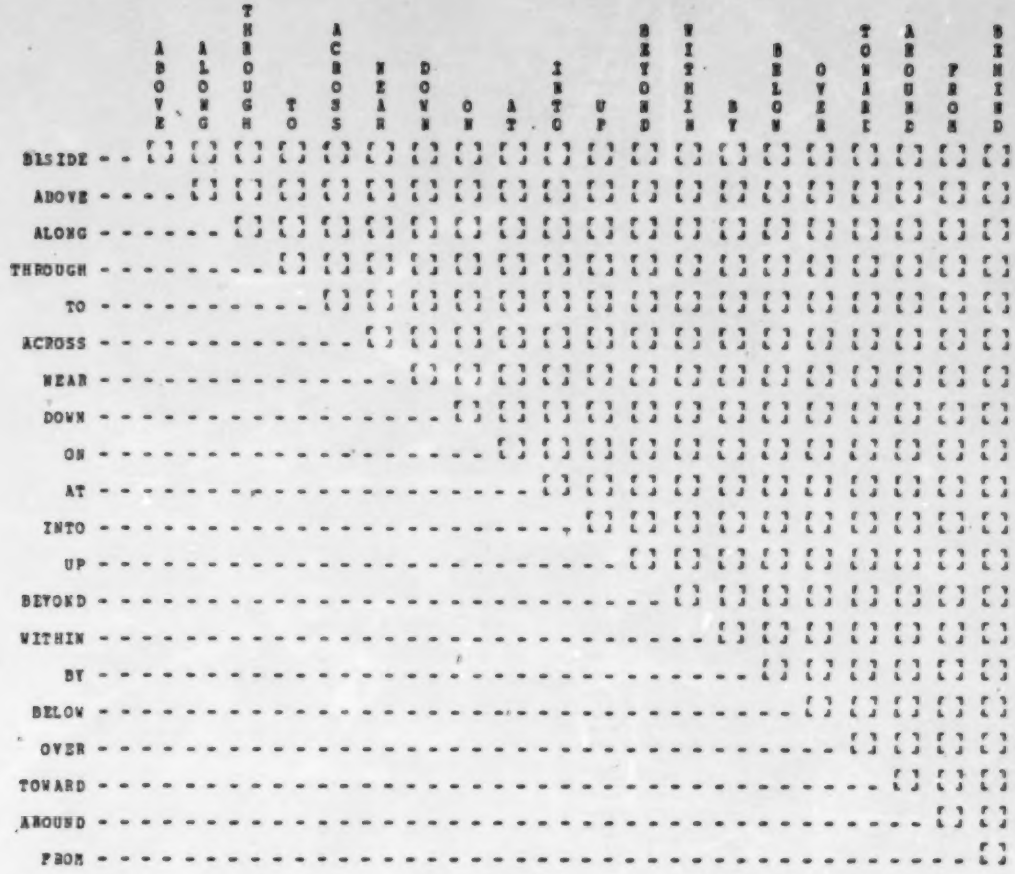


Verbs of Judging

Hypothetical Verbs



Prepositions



APPENDIX C

ABBREVIATED FORM OF THE INSTRUCTIONS TO THE SUBJECTS

NAME:

I.D. NUMBER:

AGE:

SEX: M F

FACULTY:

YEAR:

IS ENGLISH THE FIRST LANGUAGE YOU LEARNED? YES NO

INDICATE IF YOU SPEAK, READ OR WRITE OTHER LANGUAGES.

INSTRUCTIONS

1. MOST SIMILAR = a "distance" of "1".
LEAST SIMILAR = a "distance" of "9".

2. Scan the entire list first to find the pair which is MOST SIMILAR and assign "1" for the pair.

3. Scan the entire list and find the pair which is LEAST SIMILAR, for you, and assign it a "9" rating.

4. Every matrix should have AT LEAST ONE "1" and ONE "9"

rating included in it.

5. Now fill in the remaining boxes with a value of 1-9 inclusive that best represents your judgment of the similarity in meaning for the pairs.

6. THERE ARE NO CORRECT ANSWERS OTHER THAN WHAT IS CORRECT FOR YOU.

7. EACH JUDGMENT IS RELATIVE ONLY TO THE SET BEING CONSIDERED AND NOT TO ANY OTHER WORDS.

8. PLEASE ask for clarification of instructions or DEFINITIONS of terms BEFORE you begin the task.

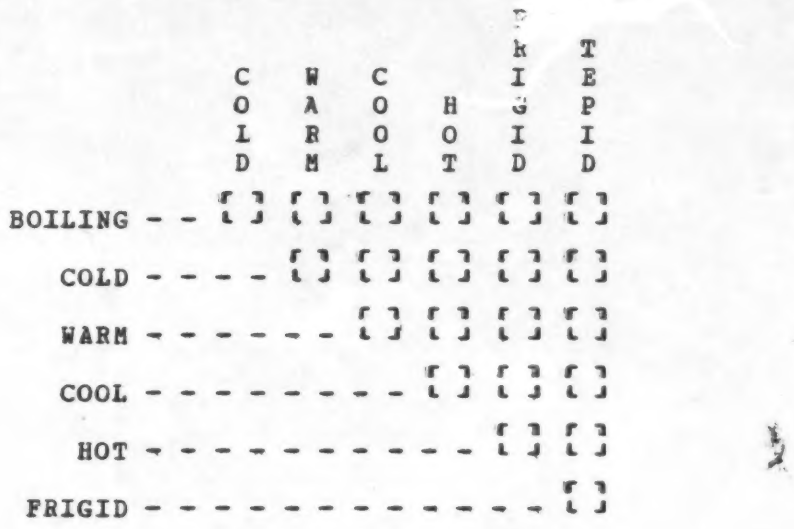
Instructions to the Subject

The purpose of this study is to collect information about your judgments of meaning similarity in words. You will be looking at the relative similarity in meaning of a defineable group of words.

Consider a simple and fairly well ordered example. A set of adjectives that could be used to describe temperature sensations are:

COLD WARM HOT COOL TEPID FRIGID BOILING

suppose this is the list you are to assess. The first step in this procedure is to scan the entire list to find the pair of words you judge to be most similar in meaning, and next, scan to find the pair you consider to be least similar in meaning. The list will be presented as an "upper triangular matrix" of boxes to facilitate comparisons among pairs of terms and it would look like this:



Let's assume, for example, that you judge the pair, COLD/FRIGID to be the most similar in meaning, and the pair, FRIGID/BOILING to be the least similar. You would assign the value "1" to the box for the first pair, and the value "9" to the box for the FRIGID/BOILING comparison. You have now provided "anchor points" for the use of the scale from 1-9. Note that any of the values from 1-9 may be used for any comparison so that if, for example, you judge the pair HOT/BOILING to be just as similar as COLD/FRIGID, both pairs may be assigned a value of "1". A complete matrix for the example might look like this:

	COLD	WARM	COOL	HOT	FRIGID	TEPID
BOILING	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
COLD		[ ]	[ ]	[ ]	[ ]	[ ]
WARM			[ ]	[ ]	[ ]	[ ]
COOL				[ ]	[ ]	[ ]
HOT					[ ]	[ ]
FRIGID						[ ]
TEPID						

The set of words which you will be asked to judge will not be as readily ordered as these but, with some preliminary thought on your part, you should be able to complete the task. There is no time limit and there is, of course, no known "correct answer". We are interested in

finding out how users of the language perceive the relative similarity among terms from a semantic domain. Therefore, the only correct response is the one which represents, as precisely as possible, the way you see the relationships.

The judgements you are making are not absolute, but simply relative to the set of terms actually given to you. Restrict your attention, then, to the set given. To help you in your task, think of each word as fitting into the following sentence frame;

He ____ go.

(He ran ____ it.)

(They ____ him.)

If there is any doubt about the meaning of a term, please check with the experimenter before proceeding to evaluate the pairs. If you have any questions please ask them now.

APPENDIX D

MEAN RATINGS AND STANDARD DEVIATIONS

HYPOTHETICAL VERBS		1	2	3	4	5	6	7	8	9	10
1 Needs to	M	0.0	5.3	3.5	5.3	2.2	3.5	3.5	5.2	6.7	6.0
	SD	0.0	2.5	2.1	1.9	2.2	1.1	1.9	2.2	1.7	1.8
2 Tries to	M	5.3	0.0	5.7	5.1	5.1	6.7	5.8	6.0	4.3	4.8
	SD	2.5	0.0	2.0	2.4	2.0	2.3	1.7	2.2	2.3	2.0
3 Ought to	M	3.5	5.7	0.0	6.0	6.0	3.6	1.3	6.7	4.7	6.1
	SD	2.1	2.0	0.0	2.3	1.9	1.9	1.2	1.7	2.3	1.9
4 Would	M	5.3	5.1	6.0	0.0	4.4	6.8	5.4	5.6	3.9	4.8
	SD	1.9	2.4	2.3	0.0	2.4	1.8	2.3	1.8	1.8	2.3
5 Will	M	5.3	4.1	6.0	4.4	0.0	4.5	5.8	1.5	7.3	6.3
	SD	2.2	2.0	1.9	2.4	0.0	2.3	1.7	0.8	1.8	2.3
6 Must	M	2.2	6.7	3.6	6.8	4.5	0.0	3.9	4.0	7.7	7.0
	SD	1.1	2.3	1.9	1.8	2.3	0.0	2.8	2.2	2.0	1.7
7 Should	M	3.5	5.8	1.3	5.4	5.8	3.9	0.0	5.0	5.3	6.0
	SD	1.9	1.7	1.2	2.3	1.7	2.8	0.0	2.4	2.6	1.6
8 Shall	M	5.2	6.0	6.7	5.6	1.5	4.0	5.0	0.0	7.0	5.3
	SD	2.2	2.2	1.7	1.8	0.8	2.2	2.4	0.0	1.3	2.3
9 Might	M	6.7	4.3	4.7	3.9	7.3	7.7	5.3	7.0	0.0	1.9
	SD	1.7	2.3	2.3	1.8	1.8	1.9	2.6	1.3	0.0	1.8
10 May	M	6.0	4.8	6.1	4.8	6.3	7.0	6.0	5.3	1.9	0.0
	SD	1.8	2.0	1.9	2.3	2.3	1.7	1.6	2.3	1.8	0.0
11 Could	M	6.4	5.5	5.8	3.9	5.7	6.5	5.0	5.8	3.0	2.9
	SD	1.7	2.1	2.1	2.1	2.0	1.8	2.0	1.8	1.9	1.5
12 Can	M	6.6	5.6	5.7	4.8	3.9	5.7	5.8	4.2	5.2	3.8
	SD	1.5	1.8	2.1	2.2	1.8	1.7	1.3	1.5	2.2	2.2
13 Is Going to	M	4.7	4.5	5.5	6.2	1.6	4.9	5.7	2.0	5.8	5.7
	SD	1.9	2.4	2.2	2.1	1.9	2.6	1.7	1.7	2.4	2.6
14 Wishes to	M	6.1	3.2	7.0	4.0	4.8	7.7	5.9	5.2	4.5	5.2
	SD	1.9	1.7	1.8	1.7	1.9	1.4	1.9	1.7	1.9	1.9
15 Likes to	M	6.8	3.9	7.5	5.1	4.6	7.3	6.6	4.8	6.2	5.6
	SD	1.8	1.6	1.3	2.3	2.0	1.6	2.1	2.1	2.1	2.1
16 Gets to	M	6.4	5.4	6.5	5.2	4.5	6.8	5.7	3.6	5.9	3.5
	SD	1.9	1.9	1.6	1.7	2.0	2.0	1.9	2.1	2.0	2.3
17 Wants to	M	5.5	2.7	7.3	4.3	4.7	7.3	7.0	5.0	5.4	5.1
	SD	2.4	1.2	1.8	2.0	1.9	1.7	1.6	1.8	1.7	2.1
18 Has to	M	3.0	6.2	3.6	6.5	4.3	1.2	3.2	3.7	7.8	7.1
	SD	2.3	2.4	2.0	2.1	2.0	0.4	1.9	2.3	1.4	1.3

HYPOTHETICAL VERBS CONTINUED

		1	2	3	4	5	6	7	8
1 Needs to	M	6.4	6.6	4.7	6.1	6.8	6.4	5.5	3.0
	SD	1.7	1.5	1.9	1.9	1.8	1.9	2.4	2.3
2 Tries to	M	5.5	5.6	4.5	3.2	3.9	5.4	2.7	6.2
	SD	2.1	1.8	2.4	1.7	1.6	1.9	1.2	2.4
3 Ought to	M	5.8	5.7	5.5	7.0	7.5	6.5	7.3	3.6
	SD	2.1	2.1	2.2	1.8	1.3	1.6	1.8	2.0
4 Would	M	3.9	4.8	6.2	4.0	5.1	5.2	4.3	6.5
	SD	2.1	2.2	2.1	1.7	2.3	1.7	2.0	2.1
5 Will	M	5.7	3.9	1.6	4.8	4.6	4.0	4.7	4.3
	SD	2.0	1.8	1.9	1.9	2.0	2.0	1.9	2.0
6 Must	M	6.5	5.7	4.9	7.7	7.3	6.8	7.3	1.2
	SD	1.8	1.7	2.6	1.4	1.6	2.0	1.7	0.4
7 Should	M	5.0	5.8	5.7	5.9	6.6	5.7	7.0	3.2
	SD	2.0	1.3	1.7	1.9	2.1	1.9	1.6	1.9
8 Shall	M	5.8	4.2	2.0	5.2	4.8	3.6	5.0	3.7
	SD	1.8	1.5	1.7	1.7	2.1	2.1	1.8	2.3
9 Might	M	3.0	5.2	5.8	4.5	6.2	5.9	5.4	7.8
	SD	1.9	2.2	2.4	1.9	2.1	2.0	1.7	1.4
10 May	M	2.9	3.8	5.7	5.2	5.6	3.5	5.1	7.1
	SD	1.5	2.2	2.6	1.9	2.1	2.3	2.1	1.3
11 Could	M	0.0	2.1	5.3	5.2	5.1	3.7	5.8	7.2
	SD	0.0	1.3	2.6	1.9	1.4	2.3	1.5	1.6
12 Can	M	2.1	0.0	3.8	5.0	4.8	2.4	6.2	5.6
	SD	1.3	0.0	2.1	2.2	1.5	2.0	1.7	2.1
13 Is Going to	M	5.3	3.8	0.0	4.7	3.8	3.4	4.5	4.9
	SD	2.6	2.1	0.0	2.1	2.1	2.2	2.1	2.6
14 Wishes to	M	5.2	5.0	4.7	0.0	1.9	5.1	1.2	7.6
	SD	1.9	2.2	2.1	0.0	0.7	1.9	0.4	1.6
15 Likes to	M	5.1	4.8	3.8	1.9	0.0	4.4	2.5	7.1
	SD	1.4	1.5	2.1	0.7	0.0	1.5	2.2	1.4
16 Gets to	M	3.7	2.4	3.4	5.1	4.4	0.0	4.7	7.1
	SD	2.3	2.0	2.2	1.8	1.5	0.0	2.2	1.6
17 Wants to	M	5.8	6.2	4.5	1.2	2.5	4.7	0.0	7.2
	SD	1.5	1.7	2.1	0.4	2.2	2.2	0.0	2.1
18 Has to	M	7.2	5.6	4.9	7.6	7.1	7.1	7.2	0.0
	SD	1.6	2.1	2.6	1.6	1.4	1.6	2.1	0.0

VERBS OF JUDGING

		1	2	3	4	5	6	7	8	9	10
1 Reproach	M	0.0	2.5	7.8	2.8	7.2	7.0	6.0	7.7	3.5	2.7
	SD	0.0	1.2	1.0	1.0	0.8	1.3	1.7	0.9	1.7	1.1
2 Blame	M	2.5	0.0	7.7	3.9	6.8	7.2	7.4	7.7	2.7	3.2
	SD	1.2	0.0	1.0	2.4	1.5	1.3	2.3	1.1	1.0	2.3
3 Praise	M	7.8	7.7	0.0	7.7	2.2	4.3	4.0	2.2	8.1	7.4
	SD	1.0	1.0	0.0	2.2	0.6	1.4	1.1	1.0	0.9	2.0
4 Deride	M	2.8	3.9	7.7	0.0	7.9	8.0	7.0	8.2	2.9	3.2
	SD	1.0	2.4	2.2	0.0	0.7	0.9	0.9	0.7	1.0	2.3
5 Approve of	M	7.2	6.8	2.2	7.9	0.0	4.1	3.4	1.4	8.5	6.3
	SD	0.8	1.5	0.6	0.7	0.0	1.0	1.1	1.0	0.7	2.2
6 Apologize to	M	7.0	7.2	4.3	8.0	4.1	0.0	3.4	2.9	7.6	6.0
	SD	1.3	1.3	1.4	0.9	1.0	0.0	2.0	1.4	1.0	2.4
7 Acquit	M	6.0	7.4	4.0	7.0	3.4	3.4	0.0	3.8	6.4	6.7
	SD	1.7	2.3	1.1	0.9	1.1	1.9	0.0	1.8	1.7	1.2
8 Accept	M	7.7	7.7	2.2	8.2	1.4	2.9	3.8	0.0	9.0	6.6
	SD	1.0	1.1	1.0	0.7	1.0	1.4	1.8	0.0	0.0	1.9
9 Reject	M	3.5	2.7	8.1	2.9	8.5	7.6	6.4	9.0	0.0	3.4
	SD	1.7	1.0	0.9	1.0	0.7	1.0	1.7	0.0	0.0	1.5
10 Chide	M	2.7	4.2	7.4	3.2	6.3	6.0	7.2	6.6	3.4	0.0
	SD	1.1	2.3	2.0	2.3	2.2	2.4	1.2	1.9	1.5	0.0
11 Convict	M	3.1	3.2	8.2	3.3	8.0	7.5	8.3	7.7	2.9	4.1
	SD	1.3	3.0	0.9	1.3	0.6	1.1	2.3	1.2	1.4	1.6
12 Forgive	M	7.3	6.8	3.4	7.7	3.2	1.9	2.1	1.9	7.8	6.5
	SD	1.1	2.4	1.0	0.8	1.1	1.7	1.0	0.8	1.3	2.1
13 Excuse	M	6.7	7.8	4.6	7.0	4.1	3.1	2.3	3.2	6.6	6.2
	SD	1.7	1.8	1.3	1.5	1.6	2.7	2.0	1.8	1.3	1.6
14 Disapprove of	M	2.8	2.7	8.1	3.3	9.0	6.7	6.7	8.2	2.8	3.3
	SD	1.3	1.1	0.9	1.6	0.0	1.2	1.0	1.2	1.8	1.9
15 Denounce	M	2.6	2.2	8.2	2.3	8.3	7.0	6.4	8.2	2.7	3.5
	SD	1.1	0.7	0.7	1.4	0.6	2.3	2.2	0.7	2.1	1.6
16 Scold	M	2.7	2.5	7.9	3.2	6.9	7.2	7.3	6.9	3.3	1.6
	SD	1.5	1.1	1.7	1.7	1.2	1.3	1.1	1.7	1.1	1.4
17 Criticize	M	2.5	3.0	7.7	2.6	7.1	6.6	6.1	6.8	3.4	3.4
	SD	1.2	2.2	2.0	1.6	1.8	1.1	1.8	1.5	1.4	2.3
18 Acclaim	M	6.9	7.1	1.9	7.6	2.5	4.4	3.9	3.1	8.2	7.2
	SD	2.0	2.3	2.0	1.3	1.8	1.6	2.0	2.0	0.7	1.8
19 Censure	M	2.7	3.7	8.2	3.2	8.1	6.5	7.2	8.6	2.8	3.5
	SD	1.9	1.8	0.7	1.8	0.8	2.0	1.2	0.7	2.4	0.8
20 Discredit	M	3.2	2.3	8.2	2.9	7.7	7.2	6.7	7.8	2.9	3.7
	SD	1.0	1.1	0.7	1.6	0.8	1.5	1.4	0.9	1.6	1.6
21 Justify	M	7.2	7.3	3.4	7.5	3.3	3.7	3.5	3.3	7.2	6.5
	SD	0.8	1.4	1.4	0.9	1.1	1.5	2.7	1.7	1.1	1.5

VERBS OF JUDGING CONTINUED

		11	12	13	14	15	16	17	18	19	20	21
1 Reproach	M	3.1	7.3	6.7	2.8	2.6	2.7	2.5	6.9	2.7	3.2	7.2
	SD	1.3	1.1	1.7	1.3	1.1	1.5	1.2	2.0	1.9	1.0	0.8
2 Blame	M	3.2	6.8	7.8	2.7	2.2	2.5	3.0	7.1	3.7	2.3	7.3
	SD	3.0	2.4	1.8	1.1	0.7	1.1	2.2	2.3	1.8	1.1	1.4
3 Praise	M	8.2	3.4	4.6	8.1	8.2	7.9	7.7	1.9	8.2	8.2	3.4
	SD	0.9	1.0	1.3	0.9	0.7	1.7	2.0	2.0	0.7	0.7	1.4
4 Deride	M	3.3	7.7	7.0	3.3	2.3	3.2	2.6	7.6	3.2	2.9	7.5
	SD	1.3	0.8	1.5	1.6	1.4	1.7	1.6	1.3	1.8	1.6	0.9
5 Approve of	M	8.0	3.2	4.1	9.0	8.3	6.9	7.1	2.5	8.1	7.7	3.3
	SD	0.6	1.1	1.6	0.0	0.6	1.2	1.8	1.8	0.8	0.8	1.1
6 Apologize to	M	7.5	1.9	3.1	6.7	7.0	7.2	6.6	4.4	6.5	7.2	3.7
	SD	1.1	1.7	2.7	1.2	2.3	1.3	1.1	1.6	2.0	1.5	1.5
7 Acquit	M	8.3	2.1	2.3	6.7	6.4	7.3	6.1	3.9	7.2	6.7	3.5
	SD	2.3	1.0	2.0	1.0	2.2	1.1	1.8	2.0	1.2	1.4	2.7
8 Accept	M	7.7	1.9	3.2	8.2	8.2	6.9	6.8	3.1	8.6	7.8	3.3
	SD	1.2	0.8	1.8	1.2	0.7	1.7	1.5	2.0	0.7	0.9	1.8
9 Reject	M	2.9	7.8	6.6	2.8	2.7	3.3	3.4	8.2	2.8	2.9	7.2
	SD	1.4	1.3	1.3	1.8	2.1	1.1	1.4	0.7	2.4	1.6	1.1
10 Chide	M	4.1	6.5	6.2	3.3	3.5	1.6	3.4	7.2	3.5	3.7	6.5
	SD	1.6	2.1	1.6	1.9	1.6	1.4	2.3	1.7	0.8	1.6	1.5
11 Convict	M	0.0	8.2	7.7	4.6	3.1	4.3	3.7	8.1	3.2	3.2	7.6
	SD	0.0	1.1	1.0	1.8	1.9	1.8	2.1	0.8	2.3	1.1	1.2
12 Forgive	M	8.2	0.0	1.7	7.2	7.3	7.2	7.4	3.5	7.7	7.1	4.9
	SD	1.1	0.0	0.8	1.2	0.9	1.9	1.2	1.2	1.1	1.4	2.1
13 Excuse	M	7.7	1.7	0.0	6.3	7.0	7.1	7.2	4.7	7.2	6.7	3.5
	SD	1.0	0.8	0.0	1.5	1.6	1.9	1.6	1.9	0.9	1.6	2.1
14 Disapprove of	M	4.6	7.2	6.3	0.0	3.2	2.4	2.5	8.1	2.8	2.4	6.8
	SD	1.8	1.2	1.5	0.0	2.7	0.8	1.7	0.9	2.3	0.8	1.1
15 Denounce	M	3.1	7.3	7.0	3.2	0.0	3.2	2.7	8.3	3.0	2.2	7.2
	SD	1.9	0.9	1.6	2.7	0.0	0.9	1.1	0.9	2.3	1.2	1.7
16 Scold	M	4.3	7.2	7.1	2.4	3.2	0.0	3.1	7.6	3.5	3.5	7.2
	SD	1.8	1.9	1.9	0.8	0.9	0.0	2.1	1.4	1.4	0.8	1.3
17 Criticize	M	3.7	7.4	7.2	2.5	2.7	3.1	0.0	7.2	3.0	3.1	7.4
	SD	2.1	1.2	1.6	1.7	1.1	2.1	0.0	1.6	2.3	1.4	1.4
18 Acclaim	M	8.1	3.5	4.7	8.1	8.3	7.6	7.2	0.0	7.8	7.6	3.7
	SD	0.8	1.2	1.9	0.9	0.9	1.4	1.6	0.0	1.7	1.6	1.2
19 Censure	M	3.2	7.7	7.2	2.8	3.0	3.5	3.0	7.8	0.0	3.2	7.2
	SD	2.3	1.1	0.9	2.3	2.3	1.4	2.3	1.7	0.0	2.0	1.0
20 Discredit	M	3.2	7.1	6.7	2.4	2.2	3.5	3.1	7.6	3.2	0.0	7.2
	SD	1.1	1.4	1.6	0.8	1.2	0.8	1.4	1.6	2.0	0.0	2.0
21 Justify	M	7.6	4.9	3.5	6.8	7.2	7.2	7.4	3.7	7.2	7.2	0.0
	SD	1.2	2.1	2.1	1.1	1.7	1.3	1.4	1.2	1.0	2.0	0.0

PREPOSITIONS		1	2	3	4	5	6	7	8	9	10
1 To	M	0.0	5.5	5.5	6.4	6.2	6.0	5.4	6.1	4.0	7.7
	SD	0.0	2.2	2.2	1.4	1.3	2.0	1.8	1.5	2.3	1.3
2 Within	M	5.5	0.0	5.5	7.3	6.1	6.9	3.5	6.9	2.3	7.6
	SD	2.2	0.0	2.2	1.5	1.4	1.2	2.1	1.7	2.3	1.2
3 By	M	5.5	5.5	0.0	5.1	3.3	6.5	5.2	5.7	5.7	6.2
	SD	2.2	2.2	0.0	2.3	1.9	1.6	2.6	2.1	1.9	2.0
4 Behind	M	6.4	7.3	5.1	0.0	5.8	7.5	6.8	7.7	7.3	4.7
	SD	1.4	1.5	2.3	0.0	2.3	1.4	1.7	1.5	1.3	2.1
5 Along	M	6.2	6.1	3.3	5.8	0.0	6.3	6.5	6.1	6.3	6.9
	SD	1.3	1.4	1.9	2.3	0.0	1.9	1.6	1.8	1.9	1.3
6 Up	M	6.0	6.9	6.5	7.5	6.3	0.0	6.2	2.1	6.6	5.3
	SD	2.0	1.2	1.6	1.4	1.9	0.0	1.8	1.8	1.9	1.9
7 Through	M	5.4	3.5	5.2	6.8	6.5	6.2	0.0	6.7	3.7	5.1
	SD	1.8	2.1	2.6	1.7	1.6	1.8	0.0	1.7	2.7	2.3
8 Above	M	6.1	6.9	5.7	7.1	6.1	2.1	6.7	0.0	6.7	3.9
	SD	1.5	1.7	2.1	1.5	1.8	1.8	1.7	0.0	1.3	2.2
9 Into	M	4.0	2.3	5.7	7.3	6.3	6.6	3.7	6.7	0.0	7.6
	SD	2.3	2.3	1.9	1.3	1.9	1.9	2.7	1.3	0.0	1.2
10 Beyond	M	7.7	7.6	6.2	4.7	6.9	5.3	5.1	3.9	7.6	0.0
	SD	1.3	1.2	2.0	2.2	1.3	1.9	2.3	2.2	1.2	0.0
11 Across	M	6.4	5.9	4.5	7.0	4.5	5.9	4.6	5.3	6.2	5.7
	SD	1.4	2.3	1.7	1.9	2.2	2.0	2.5	1.9	2.1	1.8
12 Over	M	6.5	7.2	5.9	7.0	6.1	2.9	5.8	1.6	6.4	3.8
	SD	1.9	1.4	2.2	1.3	1.6	1.7	1.8	1.1	1.9	2.2
13 Near	M	3.8	4.9	1.7	4.8	3.1	6.0	5.9	5.0	5.0	7.6
	SD	2.3	2.1	1.2	2.2	1.6	1.8	1.7	1.7	2.1	1.3
14 At	M	3.4	5.3	4.2	6.6	5.9	7.0	6.1	6.9	4.1	7.2
	SD	2.3	2.0	2.2	1.8	2.1	1.7	1.7	1.8	1.4	1.6
15 From	M	8.3	6.7	5.3	6.5	6.9	6.9	7.3	6.7	7.9	5.3
	SD	1.4	2.0	2.2	1.5	1.4	1.7	1.3	1.8	1.2	3.0
16 Toward	M	1.9	6.7	5.5	6.9	5.3	6.5	5.9	6.7	5.5	7.3
	SD	1.8	2.1	2.2	1.9	1.7	1.6	2.3	1.3	2.1	1.6
17 Beside	M	6.0	6.1	1.5	5.1	2.3	6.7	5.9	6.3	7.1	7.1
	SD	1.9	1.9	0.6	1.9	1.9	2.1	1.8	1.5	1.5	1.5
18 Around	M	6.1	6.1	4.0	4.8	4.7	6.4	6.5	5.7	6.7	6.4
	SD	2.2	2.2	2.0	2.5	2.0	1.5	2.0	2.0	1.6	2.3
19 On	M	5.3	5.2	5.2	6.9	5.4	6.1	5.4	4.3	4.4	7.1
	SD	2.5	2.2	2.5	1.5	2.7	2.5	2.5	2.0	2.4	2.0
20 Down	M	6.1	6.2	6.5	6.3	5.9	8.3	5.7	8.1	6.5	6.1
	SD	2.1	1.7	1.4	1.9	2.1	2.1	2.4	0.8	1.8	1.7
21 Below	M	7.1	7.3	4.9	6.1	5.6	8.3	6.9	8.9	7.1	6.3
	SD	1.6	1.2	2.1	1.7	2.2	0.9	1.5	0.2	1.5	2.2

PREPOSITIONS CONTINUED

		11	12	13	14	15	16	17	18	19	20	21
1 To	M	6.4	6.5	3.8	3.4	8.3	1.9	6.0	6.1	5.3	6.1	7.1
	SD	1.4	1.9	2.3	2.3	1.4	1.8	1.9	2.2	2.5	2.1	1.6
2 Within	M	5.9	7.2	4.9	5.3	6.7	6.7	6.1	6.1	5.2	6.2	7.3
	SD	2.2	1.4	2.1	2.0	2.0	2.1	1.9	2.1	2.2	1.7	1.2
3 By	M	4.5	5.9	1.7	4.2	5.3	5.5	1.5	4.0	5.2	6.5	4.9
	SD	1.7	2.2	1.2	2.2	2.2	2.2	0.6	2.0	2.5	1.4	2.1
4 Behind	M	7.0	7.0	4.8	6.6	6.5	6.9	5.1	4.8	6.9	6.3	6.1
	SD	1.9	1.3	2.2	1.8	1.5	1.9	1.9	2.5	1.5	1.9	1.7
5 Along	M	4.5	6.1	3.1	5.9	6.9	5.3	2.3	4.7	5.4	5.9	5.6
	SD	2.2	1.6	1.6	2.1	1.4	1.7	1.9	2.0	2.7	2.1	2.2
6 Up	M	5.9	2.9	6.0	7.0	6.9	6.5	6.7	6.4	6.1	8.3	8.3
	SD	2.0	1.7	1.8	1.7	1.7	1.6	2.1	1.5	2.5	2.1	0.9
7 Through	M	4.6	5.8	5.9	6.1	7.3	5.9	5.9	6.5	5.4	5.7	6.9
	SD	2.5	1.8	1.7	1.7	1.3	2.3	1.8	2.0	2.5	2.4	1.5
8 Above	M	5.3	1.6	5.0	6.9	6.7	6.7	6.3	5.7	4.3	8.1	8.9
	SD	1.9	1.1	1.7	1.8	1.8	1.3	1.5	2.0	2.0	0.8	0.2
9 Into	M	6.2	6.4	5.0	4.1	7.9	5.5	7.1	6.7	4.4	6.5	7.1
	SD	2.1	1.9	2.1	1.4	1.2	2.1	1.5	1.6	2.1	1.8	1.5
10 Beyond	M	5.7	3.8	7.6	7.2	5.3	7.3	7.1	6.4	7.1	6.1	6.3
	SD	1.8	2.2	1.3	1.6	3.0	1.6	1.5	2.3	2.0	1.7	2.2
11 Across	M	0.0	3.5	5.5	6.5	6.1	6.5	5.4	5.8	4.8	6.5	6.9
	SD	0.0	2.4	1.8	1.9	1.4	1.5	1.6	1.9	2.3	1.9	1.7
12 Over	M	3.5	0.0	5.7	6.6	7.5	6.2	6.1	5.9	3.7	7.0	8.4
	SD	2.4	0.0	2.2	1.5	1.2	1.8	1.9	1.9	2.4	1.8	1.0
13 Near	M	5.5	5.7	0.0	3.9	7.1	4.0	2.0	3.3	4.7	5.7	5.8
	SD	1.8	2.2	0.0	2.8	1.5	2.4	1.2	2.3	2.1	1.7	1.5
14 At	M	6.5	6.6	3.9	0.0	7.6	3.7	5.5	5.2	3.7	7.2	6.9
	SD	1.9	1.5	2.8	0.0	1.4	2.7	2.0	2.3	2.7	1.0	1.6
15 From	M	6.1	7.5	7.1	7.6	0.0	7.8	7.7	6.7	7.4	6.7	6.2
	SD	1.4	1.2	1.5	1.4	0.0	1.6	1.1	1.5	1.6	1.4	1.9
16 Toward	M	6.5	6.2	4.0	3.7	7.8	0.0	5.6	6.7	6.4	6.3	7.3
	SD	1.5	1.8	2.4	2.7	1.6	0.0	1.9	2.1	1.8	1.6	1.4
17 Beside	M	5.4	6.1	2.0	5.5	7.7	5.6	0.0	3.9	5.6	5.9	5.7
	SD	1.6	1.9	1.2	2.0	1.1	1.9	0.0	2.3	2.4	2.3	1.4
18 Around	M	5.8	5.9	3.3	5.2	6.7	6.7	3.9	0.0	6.3	6.6	5.5
	SD	1.9	1.9	2.3	2.3	1.5	2.1	2.3	0.0	1.6	1.6	1.9
19 On	M	4.8	3.7	4.7	3.7	7.4	6.4	5.6	6.3	0.0	6.5	7.1
	SD	2.3	2.4	2.1	2.7	1.6	1.8	2.4	1.6	0.0	2.2	1.6
20 Down	M	6.5	7.0	5.7	7.2	6.7	6.3	5.9	6.6	6.5	0.0	2.5
	SD	1.9	1.8	1.7	1.0	1.4	1.6	2.3	1.6	2.2	0.0	2.3
21 Below	M	6.9	8.4	5.8	6.9	6.2	7.3	5.7	5.5	7.1	2.5	0.0
	SD	1.7	1.0	1.5	1.6	1.9	1.4	1.4	1.9	1.6	2.3	0.0